U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET, SUITE 1100, BOSTON, MA 02114-2023

MEMORANDUM

DATE: September 3, 2002

SUBJ: ACTION MEMORANDUM - Request for a Non-Time Critical Removal Action at the Elizabeth Mine Superfund Site, Strafford, Vermont

FROM: Edward M. Hathaway, Remedial Project Manager
ME/VT/CT Superfund Section

THRU: Don Berger, Chief
OSRR II Branch

Arthur Johnson, Acting Chief
Emergency Planning and Response Branch

TO: Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration

Site ID# **0102071**

I. PURPOSE

This Action Memorandum requests and documents your approval of the non-time-critical removal action (NTCRA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9601 *et seq.*, described herein for the Elizabeth Mine Superfund Site, located on Mine Road in Strafford, VT. This Action Memorandum also requests and documents the approval of a "consistency" exemption from the $2 million and 12 month statutory limits. This NTCRA is expected to be completed within 36-48 months of mobilization and require approximately $18 million in funding.

The overall objective of the NTCRA is to control the primary source of acid mine drainage at the Elizabeth Mine Site. This action will result in a significant improvement in the water quality of Copperas Brook and a several mile section of the West Branch of the Ompompanoosuc River (WBOR). This NTCRA will be performed by the Environmental Protection Agency (EPA) using fund money as no potentially responsible party (PRP) under CERCLA is available to implement the response action in a timely manner.

This Action Memorandum does not include a request to fund any Post-Removal Site Control (PRSC). The State of Vermont has provided a letter of concurrence with the NTCRA, which is

included as Attachment 8, and has indicated that it is willing to enter into a Memorandum of Agreement with EPA to perform and finance any long-term obligations relating to the NTCRA.

This NTCRA will ensure that EPA can provide a timely response to effectively minimize threats to public health or welfare or the environment which may result from the continuing release and/or threat of release of hazardous substances at and from the Site, and is consistent with EPA's Superfund Accelerated Cleanup Model (SACM).

While the NTCRA will accelerate the overall Site cleanup by containing and reducing site contamination, it may not constitute the complete and final cleanup plan for the Site. Additional CERCLA response actions, either removal or remedial, may be necessary as more information regarding the Site conditions become available. A remedial investigation and feasibility study (RI/FS) is being performed to complete the characterization of the contamination and any additional source areas. The Record of Decision (ROD) that will document the remedial cleanup is scheduled for the fall of 2004.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

CERCLIS ID No.: **VTD9883666621**
Site ID. No.: **0102071**
Category **Non-time-critical**

The Elizabeth Mine Superfund Site includes the Elizabeth Mine and the local areas contaminated by the release of hazardous substances from the Site. The Elizabeth Mine is an abandoned copper mine located on Mine Road in the Village of South Strafford within the Town of Strafford, Orange County, Vermont. The Elizabeth Mine site is situated in a rural setting, on the east side of Copperas Hill. Topography of the area consists of north-south trending hills and valleys. Woodlands surround the mine property. Undeveloped and residential properties border the site's western margin. Site elevations range from approximately 1,000 feet to 1,300 feet above mean sea level. The property consists of two mine tailings piles, one area of waste rock and heap leach piles, two open-cut mines, several adits (horizontal mine entrances), underground shafts and tunnels, ventilation shafts, and several former ore processing buildings. Other on-site structures include those previously used for office space, a shop, a solvent/oil storage shed, an air compressor building, and a garage. The majority of the buildings are in a dilapidated condition. However, one of the buildings on the property is rented for residential purposes, and the garage has been used to store equipment.

1. Removal Site Evaluation

Based upon the results of the previous investigations performed by EPA, the VT Agency of Natural Resources (VT ANR), and the United States Geological Survey (USGS), EPA signed an Approval Memorandum in February 2000 to initiate an Engineering Evaluation/Cost Analysis (EE/CA) to assess various options for controlling and containing the source of contamination at the Site. See EE/CA Approval Memorandum (Attachment 2).

2. Physical Location

The Elizabeth Mine is located in the towns of Strafford and Thetford in east-central Vermont, approximately two miles southeast of the village of South Strafford, on the eastern flank of Copperas Hill. It is approximately 15 miles north of White River Junction and 9 miles west of the Connecticut River. See Figure 1 for Site location.

3. Site Characteristics

Four areas have been identified as potential sources of contamination (See Figure 2):

1. Three areas of waste rock, tailings, and heap leach piles:
   TP-1 a 30 acre tailing pile;
   TP-2 a 5 acre tailing pile; and
   TP-3 a 12 acre area of heap leaching piles and waste rock.

2. Two areas of excavated bedrock (referred to as the North Open Cut and the South Open Cut).

3. The underground workings (shafts and adits) that extend for almost one mile northward under the WBOR.

4. A small area of tailings and associated shafts and cuts near the South Open Cut (referred to as the South Mine).

The three areas of waste rock, tailings, and heap leach piles (TP-1, TP-2, and TP-3) as well as the North Open Cut are located within the Copperas Brook watershed. (See Figure 3) The Copperas Brook watershed drains into the WBOR, approximately six miles upstream from its confluence with the Ompompanoosuc River, near the Union Village Dam. The Ompompanoosuc River empties into the Connecticut River approximately three miles downstream of the Union Village Dam.

The South Open Cut and the South Mine are located within the Lord Brook watershed.

These two source areas discharge to a small seasonal stream that flows into Lord Brook. Lord Brook runs along the eastern side of Gove Hill until joining with the WBOR just west of the Route 132 bridge in Thetford.

The water collected within the one mile of underground mine workings discharges at a location known as the "air shaft". The water from the air shaft flows down a short drainage into the WBOR about 0.5 miles upstream of the Copperas Brook - WBOR confluence.

The Elizabeth Mine is a significant historic resource on local, state, and national scales. The Site embodies the distinctive landscape, engineering, and architectural resources that are characteristic of an early nineteenth- to mid-twentieth-century American metal mining and processing site. The Site constitutes one of the largest and most intact historic mining sites in New England and includes the only intact cluster of hard-rock mining buildings in the New England.

Historically, the Elizabeth Mine was the site of a major nineteenth century U.S. copperas (iron sulfate) manufacturing plant and is associated with successful patents for copperas production. Copperas is a crystalline green hydrous iron sulfate that has been used for a variety of purposes including: production of sulfuric acid; a disinfectant and sheep dip; astringent medicine; to blacken and color leather; and as a drier in ground pigment manufacturing. Major production of copperas began in 1810 and ended in the 1880's. In 1830, Strafford Copper Works was formed to extract copper from the mine. During the early mining operations, copper was smelted on-site. Underground mining began in the early to mid-1800s. The mine was worked intermittently for copper from 1830 until 1930. In 1942, the mine reopened in response to World War II. Most of the underground copper mining occurred between 1942 and the mine's final closure in 1958.

The Elizabeth Mine is also associated with a number of significant commercial, scientific, and political figures, including Isaac Tyson, Jr., a Baltimore, Maryland-based chemical and mining figure who was recently inducted into the American Institute of Mining, Metallurgical and Petroleum Engineers' (AIME) Mining Hall of Fame.

EPA has determined the Elizabeth Mine Site to be eligible for listing on the National Register of Historic Places. Historic property boundaries, as determined by the eligibility assessment for the National Register of Historic Places and as accepted by the Vermont State Historic Preservation Officer (SHPO), are inclusive of copperas- and copper-mining landscapes formed during the late-eighteenth to mid-twentieth centuries. Historic and archaeological resources, which include ore extraction and processing sites, support infrastructure, and waste deposits, are distributed over approximately 500 acres, extending from Copperas Hill northeast to the WBOR and southward to Lord Brook. Portions of the historic property will be directly and indirectly impacted by cleanup activities. For historic resource management purposes, the areas of direct impact include

mine waste deposits (TP-1, TP-2, and TP-3) and areas favored under some options for the installation of treatment systems. Indirect effects include potential impacts during the NTCRA to all other areas of the historic property.

The tailings, waste rock, and heap leach piles at the Elizabeth Mine Site are private property with seven current landowners: TP-1 and TP-2 are part of two independently owned parcels of property; TP-3, South Open Cut, North Open Cut, and South Mine are part of 4 independently owned parcels (different owners than TP-1 and TP-2); ownership of Air vent is independent of the other parcels. In addition to these seven, multiple properties are located above the underground workings which may also be a source of contamination.

EPA provided the Towns of Strafford and Thetford with a Redevelopment Initiative Grant to hire a consultant to evaluate future use of the property and provide EPA with information regarding possible future uses to consider in the design of the cleanup. In a 2002 survey of both towns the majority of the survey respondents prefer conservation, interpretation and education, and recreation as the future use of the Site. Given the number of private parties with ownership of the Site and the lack of funds available for acquisition and management of the property, future use of the Site is uncertain at this time.

4. Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant

Information gathered from state, federal and owner/operator records indicate that hazardous substances were used and disposed of at the Site. As a result of improper waste disposal practices many of the hazardous substances have been released into the environment. Site investigations, as further documented below, have detected hazardous substances in the surface water, soils, groundwater, and sediments within and adjacent to the Site. In particular, aluminum, cobalt, copper, iron, manganese, and zinc have been detected at concentrations above those acceptable for ecological exposure. All of the compounds of concern are "hazardous substances" as defined by CERCLA Section 101(14) and 40 C.F.R. Section 300.5.

The release of the hazardous substances into the environment has resulted in the contamination of surface water, soils, groundwater, and sediments. While these hazardous substances pose only a limited human health threat from exposure to contaminated groundwater, substantial ecological risks are present as a result of the hazardous substances migrating from the Site.

4(a) Nature and Extent of Contamination

The three source areas addressed by this NTCRA are located in the Copperas Brook watershed. Copperas Brook flows from its headwaters near TP-3 over a distance of nearly one-mile to its confluence with the WBOR.

Upper Copperas Brook originates a short distance from the base of TP-3 and flows through a divide in TP-2 onto the surface of TP-1, where it enters a small pond (a former settling pond for tailing fines). A decant tower diverts water from the surface of TP-1 through a concrete pipe, to a discharge point at the northeast corner of the tailings pile. Water from the pipe combines with ground water discharge seeps from the base of TP-1 to form Lower Copperas Brook which runs through the wooded areas and wetlands below the tailings.

The Copperas Brook watershed is approximately 300 acres in size, has an overall vertical drop of approximately 750 feet, and during EPA monitoring in 2000 - 2001 experienced a range of flow from approximately 25 gpm to over 2000 gpm at the confluence with the WBOR. The upper portion of the Copperas Brook watershed normally experiences low flows in summer months, in the range of less than two gallons per minute (gpm) to 10 gpm at EPA's sample Location Number 2 (below TP-3). Spring flow and storm events result in substantially higher flow. Spring flows have been measured at 76 – 360 gpm. Storm event flow of over 300 gpm has been measured at the Location 2 gauging station.

TP-3 sits primarily on bedrock or a thin veneer of overburden material. TP-1 and TP-2 appear to be underlain by a thick glacial till of very low hydraulic conductivity. Although a thin sand unit has been found between the tailings and the till, it is believed that the till layer limits the upward flow of ground water into the tailings. Surface water/ground water modeling suggests that approximately 80-90% of the water within the tailings results from surface water and shallow groundwater run-on from upper Copperas Brook; the remaining 10 to 20% is provided mostly by direct precipitation and snowmelt with a small component of flow from deep ground water.

Acid conditions in surface water are generated by the interaction of waste sulfide minerals (pyrrhotite, pyrite, and chalcopyrite) with water and oxygen. The oxidation of sulfides exposed to natural weathering conditions produces acid, which in turn dissolves metals such as copper, zinc, aluminum, and cadmium. Copperas Brook acquires most of its load of metals and acidity in the TP-3 area. Rain water and ground water discharged within the Copperas Brook watershed transport metals, acidic water, and tailings fines to the WBOR, where impacts to biological communities and water/sediment quality have been observed and recorded by EPA and others. The acidity of Copperas Brook averages around 650 milligrams per liter of calcium carbonate equivalent. The reference portion of

the WBOR, upstream of the air vent and confluence with Copperas Brook, has an average alkalinity around 100 milligrams per liter of calcium carbonate equivalent. Under present conditions, 6.5 gallons of surface water from the WBOR are needed to neutralize the acidity contributed by each gallon of water from Copperas Brook.

Each Site medium will be discussed separately below:

4(a)(i) Tailings and Waste Rock

The principal tailings piles located at the Site (TP-1 and TP-2) were generated through sulfide ore milling operations through the 1940s and 1950s. These two waste piles are wedge-shaped, with the thickest sections situated along the down-slope, north-facing sides. TP-1 is approximately 30 acres in area, and has a maximum thickness of approximately 110 feet; TP-2 is approximately five acres in area and has a maximum thickness of approximately 35 feet. Directly underlying TP-1 and TP-2 is the thin layer of gravel and debris from the pre-tailings ground surface.

TP-1 and TP-2 are composed of crushed and processed ore that is a fine sand/silt-sized material. The minerals jarosite and goethite dominate the oxidized surface of the tailings. During July/August 2000, samples of the upper oxidized material were collected and analyzed for metals concentrations and for grain-size distribution by the USGS. Fine-grained sand constitutes more than 50% (by weight) of the surface material in samples collected during the installation of piezometers on TP-1. Below this oxidized zone, the tailings consist of a tightly-compacted black anoxic silt/fine sand. There appears to be some (minor) vertical differentiation throughout the pile, with a thin clay-rich accumulation layer in several borings at a depth of several inches to one foot below the tailings surface.

TP-1 and TP-2 are representative of a class of tailings impoundments described as “upstream tailings dams” The tailings impoundments started with an earthen dam constructed at the toe of the impoundment and tailings were deposited from down-slope (downstream) to up-slope (upstream). This approach resulted in wedge-shaped tailings pile, where the down-slope edge is topographically higher than the up-slope edge. By depositing tailings slurry from the down-slope side, coarser sandy material created a dry beach at the down-slope edge and finer materials were transported by gravity and deposited in a settling pond within the upstream interior of the pile. Today, a decant tower for the interior settling pond can be observed on the surface of TP-1. The decant tower and

drainage system for TP-2 has collapsed and eroded.

A volume analysis of TP-1 and TP-2 was completed by comparing the data for the period prior to the creation of TP-1 and TP-2, utilizing a 1896 USGS topographic map to the recent (spring 2000) topographic surveys. The 1896 (pre-TP-1 and TP-2) topographic data was calibrated using the borehole information as a guide. From this analysis, the total volume of the combined TP-1 and TP-2 was calculated to be approximately two million cubic yards.

TP-3 has a very irregular surface, with thickness ranging from several feet to more than 40 feet. TP-3 is divided into several subareas on the basis of historic operations and the relative percent of unoxidized sulfide material present. Colorful piles of variably pyrolyzed sulfide ore are present over an area of approximately six acres in the center of TP-3, representing "heap leach" residues from the production of copperas throughout the 1800s. Bright orange-red hematite-rich piles represent thoroughly pyrolyzed (roasted) massive sulfide. Yellow limonite and jarosite-rich rock represents waste material (deposited on top of the copperas heap leach piles) from later phases of copper mining. Adjacent to the North Open Cut, especially toward the southern end of the cut, low-sulfide content waste rock piles are mixed in with the sulfides used for copperas production. Given the nature of the materials present, TP-3 should not be referred to as "tailings"; however, the TP-3 nomenclature has meaning to most local citizens and site investigators. Therefore, for consistency, this area will be referred to as TP-3 in this report.

The USGS sampled and analyzed portions of TP-3 in 1998. The USGS divided TP-3 into six subareas based on differences in surface color and texture. Paste pH composite samples were measured in the field, and samples were analyzed for mineralogy and chemistry. Colors were determined on dry materials by comparison with Munsell soil color charts. These data show that the red piles of the old (copperas) workings (TP-3) are hematite-rich and have slightly higher paste pH values than the adjacent jarosite-rich piles. Weathered ore and waste-rock litters the upper parts of TP-3. After periods of dry weather, white coatings of efflorescent iron sulfate salts cover sulfide-rich cobbles and boulders, creating a "snowball" appearance. The minerals halotrichite, melanterite and rozenite (copper/iron/aluminum salts) wash away with each rainstorm event. The mineralogy and spatial distribution of minerals in TP-3 are important from the standpoint of acid-generation potential. Detailed mapping and analysis of acid-generation potential across TP-3 will be

accomplished during the design phase of the NTCRA and/or RI/FS.

4(a)(ii)Soil Contamination

Surface soil samples were collected from three residences located along Mine Road near the Elizabeth Mine Site in July and November 2000. Each sample was analyzed for metals through the EPA Contract Laboratory Program (CLP). The soil data revealed a few instances where levels of iron, lead, and thallium warrant further study as part of the RI/FS for the site, because levels were greater than background. The concentrations of these contaminants were not at levels considered to represent an acute (short-term) hazard. The Agency for Toxic Substances and Disease Registry (ATSDR) confirmed EPA's assessment that the residential soil data do not indicate any current risks that would warrant immediate EPA action. All of the soil data has been transmitted to the residents and the Vermont Department of Public Health. A more detailed evaluation of the soil data will be presented in the Baseline Human Health Risk Assessment, prepared as part of the RI/FS.

4(a)(iii) Ground Water Contamination

Ground water studies to date are limited to samples from residential wells along Mine Road, downgradient and side gradient from the Site, and water level measurements from piezometers within and adjacent to the tailings piles. Ground water quality information is available from nine residential wells located along Mine Road, west of TP-1 and TP-2 (EPA 2000 and 2001 sampling program). The concentrations of chemicals detected in drinking water were compared with the primary Maximum Contaminant Levels (MCLs), secondary MCLs (EPA, 1991, 1992), and with the Vermont Health Advisories (VHAs) (VT Department of Health, 1998).

Drinking water from one former residence, situated at the downgradient edge of TP-3, exceeded federal drinking water standards and/or EPA risk criteria for copper, cadmium, aluminum, and sulfates. The resident re-located and the well is no longer used. None of the other residential wells sampled, nor the monitoring well installed adjacent to TP-3 indicate an adverse impact to groundwater by the mine.

To evaluate the nature of ground water flow within the tailings, nine piezometers were installed through the tailings in July/August 2000. The piezometers were developed and allowed to equilibrate with local pore pressures. Monthly piezometer monitoring data (piezometric head) were

collected for both the tailings and the till. The measurements collected to date reflect summer, fall, and winter conditions. Ground water elevations did not fluctuate significantly between the sampling events, suggesting a hydraulic dampening effect within the tailings that masks the impact of individual storm events. More data is needed to evaluate the seasonal impact on the ground water from precipitation and infiltration, particularly in the spring.

Measurements within and below TP-1 and TP-2 indicate that ground water flow is toward the north-northwest, generally following the pre-tailings surface. Nested piezometer couplets indicate that there is a slight downward vertical gradient throughout TP-1 and TP-2. Hydraulic conductivity and porosity have not been determined at this point. The information gathered to date indicates that the basal till underlying TP-1 and TP-2 is a low-yield, nearly impervious geologic material of considerable thickness overlying bedrock. The thin, irregular water-bearing unit between the tailings and till does not appear to be a significant ground water resource, but it may be a preferred hydraulic pathway for minor lateral flow and recharge to the base of the tailings. The downward vertical gradient present during the summer, fall, and winter months suggests, however, that any recharge to the tailings from below is limited.

Recharge of ground water within the tailings material in TP-1 and TP-2 is largely influenced by surface water infiltration. At present, ground water infiltration and transport related to the decant tower and the geologic units below the tailings is not well documented. Further investigation is necessary to evaluate the significance of these features. Several ground water seeps are observed (year-round) at the toe of TP-1, with fewer seeps at the toe of TP-2. Individual seep flow is as much as 15 to 20 gallons per minute. Flow rates for most seeps do not appear to vary significantly on a seasonal basis, suggesting that the tailings pile “dampens” any seasonal or episodic rain or snowmelt event.

A concrete diversion culvert, once situated below TP-2, has completely eroded, resulting in direct discharge of the upper reach of Copperas Brook onto the surface of TP-1. This has resulted in a year-round surface pond, measuring one to two acres, on the top of TP-1. A similar concrete decant tower remains in place below TP-1, to channel Copperas Brook flow from the pond back into the natural drainage channel at the foot of TP-1.

A piezometer situated in TP-3 indicates the presence of a near surface

unconfined water-bearing horizon above the bedrock and a second saturated zone within the highly fractured bedrock. Depth to bedrock at TP-3 is approximately 12 feet below ground surface. The piezometer (nested-pair, representing different hydraulic zones) indicates that a significant upward vertical gradient is present between the two water-bearing zones in this area. Recharge to the bedrock aquifer is likely through a combination of precipitation/infiltration and flooded underground workings. The horizontal gradient in the TP-3 area, while not known at this time, is likely significant and follows the natural topography. A more detailed evaluation of the groundwater data will be presented in the Baseline Human Health Risk Assessment, prepared as part of the RI/FS.

4.(a)(iv)<u>Surface Water and Sediment Contamination</u>

To assess the extent of environmental impact from the Elizabeth Mine, EPA collected surface water and sediment samples throughout the Elizabeth Mine area, within the WBOR watershed. Sample locations are broadly divided into the following nine groupings (See Figure 4 for surface water and sediment sampling locations):

- *WBOR upstream of Mixing Zone* includes the WBOR upstream from the Air Vent and Copperas Brook
- *Unaffected tributaries to the WBOR* include Sargent Brook, Abbott Brook, Fulton Brook, Jackson Brook, Bloody Brook, and lower Lord Brook
- *Air Vent Mixing Zone* includes locations within the WBOR between the Air Vent and the confluence with Copperas Brook – approximately 2,500 feet in length
- *Contamination Source Areas* includes location within the Copperas Brook watershed and the Air Vent prior to discharge into the WBOR
- *WBOR Mixing Zone* include the section of the WBOR from Copperas Brook confluence to a point approximately 2500 feet downstream
- *WBOR Below Mixing Zone* includes the stretch of WBOR between the EBOR/WBOR confluence and EPA sample location No. 42
- *Affected tributaries of the WBOR* include upper Lord Brook, two intermittent streams on Mine Road, and an intermittent stream within the Copperas Brook drainage
- *East Branch of the Ompompanoosuc River* (EBOR)
- *Ompompanoosuc River below confluence of EBOR and WBOR*

For surface water, fifteen contaminants were detected at concentrations above Vermont Water Quality Standards (VT WQS)) or EPA criteria, including: aluminum, barium, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, selenium, silver, thallium, vanadium, and zinc. VTWQS are available for cadmium, chromium, copper, cyanide, iron, lead, selenium, and zinc. EPA used published reference sources (EPA, 1996, EPA, 1999, Suter, 1996) to establish the criteria used in this report for aluminum, barium, cobalt, manganese, silver, thallium, and vanadium.

Nine of these 15 contaminants appear to be clearly related to the source material (tailings, waste rock, and heap leach piles) based on their concentration and frequency of occurrence: aluminum, cadmium, cobalt, copper, iron, manganese, selenium, silver, and zinc. Six of these metals (aluminum, cobalt, copper, iron, manganese, and zinc) represent the bulk of the risk and have been designated as the primary Contaminants of Concern (COCs). The remaining three from the subset of nine contaminants believed to be Site related (cadmium, selenium, and silver) as well as the other six contaminants detected above reference criteria (barium, chromium, cyanide, lead, thallium, and vanadium) warrant further evaluation as part of the RI/FS.

Two sediment-sampling events were completed in 2000 and one in 2001. The first was completed in July 2000 and the second in September 2000. The 2001 sediment-sampling event was also conducted in September, along with a synoptic surface water-sampling event. In July 2000, 41 locations were sampled for total metals, acid volatile sulfide/simultaneously extracted metals (AVS/SEM), grain size, and Total Organic Carbon. One location was sampled for cyanide, and five locations were sampled for Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), pesticides, and PCBs. In October 2000, 11 of the 41 locations were sampled for total metals and AVS/SEM. In September 2001, 25 locations were sampled for sediment, including eight samples in the “mudflat” area at the confluence of the Ompompanoosuc and Connecticut Rivers. A more detailed evaluation of the surface water and sediment data will be presented in the Baseline Human Health Risk Assessment, prepared as part of the RI/FS.

4(a)(v) <u>Ecological Impact Summary</u>

The biological community (benthic organisms and fish) is severely impacted in Copperas Brook, the upper reach of Lord Brook below the South Open Cut, and in the Mixing Zone of the WBOR below Copperas Brook. The WBOR does not achieve conditions similar to upstream (Reference) locations until some point below Union Village Dam, although algae metals concentrations remain high below the dam. Surface water and sediment collected from Copperas Brook, the section of the Mixing Zone closest to Copperas Brook, and the air vent are highly toxic to aquatic organisms, such that survival of aquatic receptors in this area is not likely. The toxicity test results indicate that these toxic effects (mortality of the biota from exposure to the water or sediments) are not present below the Mixing Zone. The benthic and fish surveys of the WBOR indicate that the Air Vent contribution to the WBOR contamination is not significant in terms of biological impact, even though water chemistry results indicate the potential for impacts to the aquatic organisms in this stretch of the river. See Figure 5 for a summary of the ecological results.

Collectively, the various lines of evidence suggest that EPA Location 27, situated upstream of the confluence of the WBOR with the Ompompanoosuc River, represents the best estimate for the location where the WBOR achieves Vermont Water Quality Criteria for biological metrics. Full recovery to upstream (Reference) conditions is not observed until Location 44 at Union Village Dam. Numerical VTWQS are exceeded as far downstream as EPA Location 44. The distance from the Copperas Brook confluence to EPA Location 44 is approximately six miles. Since all of the lines of evidence show that Copperas Brook and the Mixing Zone are the most severely impacted waterways it can be inferred that TP-1, TP-2, and TP-3, which are the contaminant sources located within the Copperas Brook drainage, are the cause of the impacts to the WBOR. These impacts firmly support the need for an early cleanup action (NTCRA) to address the principal sources of AMD. See Tables 1 and 2 for the Hazard Indices associated with the contaminants of concern and Figure 6 for the extent of the ecological impacts.

5. NPL Status

The Site was proposed for inclusion on the National Priorities List (NPL) in December 2000. The Site was finalized on the NPL on June 14, 2001 (F.R. Vol 66, No. 116, pages 32235-32242).

EPA began the remedial investigation and feasibility study of the Site in 2000.

6. Maps, Pictures and Other Graphic Representations

Attachment 1 - Figures and Tables

Attachment 2 - EE/CA Approval Memo

Attachment 3 - ARARS Tables

Attachment 4 - EE/CA Fact Sheet

Attachment 5 - Response to Comments

Attachment 6 - Public Hearing Transcript

Attachment 7- Administrative Record Index

Attachment 8 - Letter of Concurrence from VT ANR

Attachment 9 - Enforcement Addendum

II. B. Other Actions to Date

1. Previous Actions

In 1988, the U.S. Army Corp of Engineers (USACE) discovered four large transformers in the TP-2 area that appeared to be leaking. USACE notified the Vermont Department of Environmental Conservation (VTDEC) of the transformers for follow-up investigation. The mine owner claimed that equipment at the mine belonged to the former mine owners and that the transformers had been on the property since 1946. The owner pointed out the presence of 12 smaller transformers in one of the mine buildings. USACE discovered 16 additional smaller transformers in the compressor building. In November 1991, VTDEC sampled the transformers for polychlorinated biphenyls (PCBs). The analytical results indicated that one transformer contained over one gallon of PCB oils. In February 1992, the owner was requested under Title 10 V.S.A. Section 1283 to remove the oil for proper disposal. In March 1992, the owner notified the VTDEC that he had complied with the removal order.

In July 1989, it was discovered that the mine was being used as an illegal dumpsite for out-of-state construction/demolition debris and possibly for industrial/domestic sewage sludge. The dumpsite was located in the central portion of TP-1. Excavation pits were dug in the dump area to determine if hazardous wastes were present. During excavation, soils were analyzed with a photoionization detector and samples of a sludge-like material

were collected by VTDEC for analysis. The only metals detected above the method detection limits were lead (250 ppb) and zinc (8,400 ppb). No semivolatile organic compounds (SVOCs) were identified by Method 8270 analysis. A total of nine VOCs were identified by Method 8240 analysis. Two compounds present in the sample were acetone (17 ppb) and an unknown phthalate ester (40 ppb). The sludge and debris were left in-place and the excavated soil back-filled. No removal actions were undertaken. The owner subsequently covered portions of TP-1 (up to 60%) with a thin soil cover. Indigenous species of grass and acid-tolerant trees and shrubs have established themselves on the soil cover.

No previous EPA-lead CERCLA removal or remedial actions have been undertaken at the Site.

2. Current Actions

The Site is currently under investigation as part of a RI/FS. At the same time, in order to control the continuing contamination of the surface soils, sediments, and groundwater as expeditiously as possible, EPA conducted an EE/CA to support a non-time critical removal action. (see EE/CA Approval Memorandum, Attachment 2). The EE/CA evaluated various response actions to control the source of contamination at the Site, based upon cost, effectiveness, and implementability. The EE/CA was completed by a contractor for the United States Army Corps of Engineers though an interagency agreement (IAG) with EPA under EPA oversight.

The final EE/CA Report was placed into the site file in March 2002. EPA mailed copies of the EE/CA Fact sheet describing the proposed NTCRA to the State of Vermont, local officials, local residents, PRPs, and other interested parties. EPA held public informational meetings on March 27 and March 28, 2002 to present the EE/CA and EPA's preferred alternative (see EE/CA Fact Sheet, Attachment 4). EPA then held a public hearing on April 10, 2002 to receive oral comments. The public comment period began on March 15 and ended on April 15. The NTCRA selected in this Action Memorandum is EPA's formal decision stemming from the EE/CA process in compliance with CERCLA and the National Contingency Plan (NCP), 40 C.F.R. Part 300. Approximately 65 discrete sets of comments, in addition to the statements at the formal hearing were received in writing during the comment period. The comments were fully considered in the preparation of this Action Memorandum.

While the NTCRA will accelerate the overall Site cleanup by containing and reducing site contamination, it may not constitute the complete and final cleanup plan for the Site. Additional response actions, either removal or remedial, may be considered as more information regarding the Site conditions become available. The NTCRA is consistent with the RI/FS and long-term remedial response at the Site.

C. State and Local Authorities' Role

1. State and Local Actions to Date

The State supported the inclusion of the Site on the NPL and has since reviewed and commented on the various components of the RI/FS. EPA consulted with the State regarding the performance of a non-time-critical removal action at the Site, and the State has indicated its full support for this expedited approach to site cleanup. The VT ANR has provided EPA with a letter of concurrence regarding the NTCRA (See Attachment 8).

Local authorities have been actively involved in the Site and have expressed support for the NTCRA. The selectboards for both Strafford and Thetford submitted comments in support of the cleanup action proposed by EPA (See Attachment 5).

2. Potential for Continued State/Local Response

The State and local authorities are expected to maintain a high level of interest in the Site. The State is expected to review and comment on the upcoming RI/FS activities, as well as the final selection of a remedial action. The State will also participate in the implementation of the NTCRA as a support agency. The State will have responsibility for performing the post-removal-site control (PRSC) and plans on entering into a Memorandum of Agreement with EPA that will document its commitment to funding and conducting the required PRSC. Local governments are expected to remain highly involved in the design and implementation of the cleanup as well as the RI/FS. The major vehicle for local government and community involvement will be through the Elizabeth Mine Community Advisory Group (EMCAG).

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT AND STATUTORY AND REGULATORY AUTHORITIES

Section 300.415(b)(2) of the NCP lists a number of factors for EPA to consider in determining whether a removal action is appropriate, including:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- (ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- (iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;
- (iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;
- (v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;
- (vi) Threat of fire or explosion;
- (vii) The availability of other appropriate federal or state response mechanisms to respond to the release; and
- (viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment.

An evaluation of the conditions at the Elizabeth Mine Site indicates that several of these factors are applicable, as described below.

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants. There is current actual exposure of animals to hazardous substances, pollutants, and contaminants such that the benthic organism and fish communities have been severely impacted. A five-mile stretch of the WBOR violates VTWQS for both numerical and biological water quality measures. The entire one mile stretch of Copperas Brook and the one mile stretch of the WBOR downstream of its confluence with Copperas Brook were found to be severely impacted based upon fish and benthic surveys. In addition, there is a potential exposure to hazardous substances, pollutants, or contaminants from ingestion of groundwater by individuals within close proximity to TP-3. A water supply was recently removed from use due to contamination above federal and state drinking water

standards.

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems. Prior to the termination of the use of one water supply well, there was actual contamination of a drinking water supply by the mine waste. The potential for future contamination of water supplies remains for any future wells installed in close proximity to the tailings. The aquatic ecosystems of Copperas Brook and the WBOR have been substantially impacted by the tailings. Surface water data documents actual contamination of the entire one-mile length of Copperas Brook and an additional five miles of the WBOR, extending to below the Union Village Dam. Sediment data suggests that contamination extends to the confluence of the Connecticut River, which is another three miles downstream of the dam. Site-related contamination has clearly resulted in significant impairment to ecosystems in the mine area.

(iv) High concentrations of hazardous substances, pollutants, or contaminants in soils at or near the surface that may migrate. High concentrations of metals (including aluminum, cadmium, chromium, cobalt, copper, iron, manganese, and zinc) have been detected in tailings materials exposed at the surface in the Elizabeth Mine area. Currently, a large portion of TP-1 and TP-2 (five to seven acres) has little to no vegetated cover. TP-3 is largely unvegetated. Contamination is being continually released from these areas through erosion and acid mobilization of the metals. Local residents report that migration of dry oxidized tailings through wind-blown dust has been a problem in the past. Wind blown transport of tailings would continue to be a problem if actions are not taken to stabilize (cover) the TP-1 and TP-2 tailings.

(v) Weather conditions that may cause hazardous substances, pollutants or contaminants to migrate or be released. The principal contaminant transport pathway at the Elizabeth Mine Site is storm water runoff. The mine is situated in a mountain valley in east central Vermont, where storm conditions through much of the year produce short-term rainfall events. Annual precipitation averages approximately 35 inches in the South Strafford area. Erosion of exposed tailings results in acid drainage with high dissolved and suspended metals runoff, which flows into the headwaters of Copperas Brook and ultimately to the WBOR. Spring snowmelt conditions contribute the greatest metal and acid loads to the surface water environment over a four-week period from early April to early May. Snow pack at the beginning of the spring melt is typically in the three to four-foot range throughout the Copperas Brook watershed. Catastrophic failure of TP-1 resulting from extreme weather events or small earthquakes could have a significant long-term adverse effect the quality of the WBOR.

(vii) The availability of other appropriate federal or state response mechanisms to respond to the release. There are no other known federal or state funds or response mechanisms available to finance this action. The State of Vermont will be committing to a significant financial obligation just to maintain the PRSC once the NTCRA is completed.

Combined, these factors indicate that the tailings, water rock, and heap leach piles at the

Elizabeth Mine Site constitute a threat to human health or the environment (principally to sensitive ecological receptors) through the release, or potential release, of hazardous substances, pollutants, and contaminants into the environment. A NTCRA is therefore appropriate to abate, prevent, minimize, stabilize, mitigate, or eliminate such threats. In particular, a NTCRA is necessary to provide source control measures to remove, control, or contain the risk to the sensitive ecological receptors within Copperas Brook and the WBOR as well as potential future users of the groundwater.

This removal is designated as non-time-critical because more than six months planning time is available before on-site activities must be initiated. Prior to the actual performance of a non-time critical removal at this Site, Section 300.415(b)(4) of the NCP requires that an engineering evaluation/cost analysis (EE/CA) be performed in order to weigh different response options. An EE/CA was performed, and the EE/CA Report was distributed (and made available) to the public, as discussed previously.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances, pollutants, or contaminants, from this Site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. EXEMPTION FROM STATUTORY LIMITS

This removal will require funding above the $2 million and will require more than 1 year to implement, which are both exceedances of statutory ceilings established under 42 U.S.C. §§ 9604 (c)(1). The proposed NTCRA is projected to cost $18 million and take 36-48 months to complete. However, a "consistency" exemption under 42 U.S.C. §§ 9604 (c)(1)(C) is invoked through this Action Memorandum to allow EPA to exceed $2 million ceiling and 12 month limit in order to implement the NTCRA proposed in this Action Memorandum.

The proposed continued response actions, as described in this Action Memorandum, are otherwise appropriate and consistent with the remedial action to be taken. The NTCRA included in this Action Memorandum will control the primary source of contamination to the surface water and sediments of Copperas Brook and the West Branch of the Ompompanoosuc River. Consolidation and capping along with treatment of the run-off and seeps are response actions that would be consistent with the type of actions that would be considered as part of the expected remedial response and do not preclude any future remedial response that may be necessary.

The implementation of the NTCRA is necessary to prevent the further migration of the

contamination in the soils. Authority to invoke this consistency exemption has been delegated from the Regional Administrator, EPA Region I, to the Director of the EPA Region I Office of Site Remediation and Restoration (Delegation No. 14-2) on April 5, 2002.

VI. PROPOSED ACTIONS AND ESTIMATED COSTS

1. Removal Action Objectives

The following removal action objectives have been developed for the Site:

- Achieve VT WQS (chemical and biological) as well as other applicable standards for the WBOR by preventing or minimizing the discharge of water with mine-related metals contamination to Copperas Brook and the WBOR;
- Minimize erosion and transport of tailings or contaminated soil into the surface waters of Copperas Brook and the WBOR;
- Evaluate the stability of the waste piles (tailings, waste rock, and leach piles) and modify slope configurations (re-grading, covering, or buttressing) as necessary to provide for an acceptable level of long-term stability;
- Consider measures to minimize and, if possible, avoid an adverse effect on historic resources at the Site, as required by the National Historic Preservation Act (NHPA); and
- Comply with all applicable, relevant, and appropriate federal and state regulations (ARARs) while achieving these objectives.

2. Proposed Action Description

Alternative 2C: Capping, surface water diversion/groundwater diversion, and passive treatment

The objective of the selected alternative, which was identified as Alternative 2C in the EE/CA and Proposed Plan, is to minimize the generation of AMD and to capture and treat the remaining AMD that flows from the three tailings piles (TP-1, TP-2, and TP-3). The goal of this action will be to improve the water quality of the WBOR and to minimize the effect of the cleanup on the historic resources located at the Site. See Figure 7 for a conceptual plan view of the cleanup.

The major components of Alternative 2C include:

1. Surface water and groundwater diversion ditches: Diversion ditches will be installed around the perimeter of the tailings to intercept clean water and carry this water around the tailings. This will prevent clean water from coming into contact with the

sulfide-bearing materials that cause the AMD. These trenches will be installed to a depth that will intercept shallow groundwater that may also be flowing into the tailings.

2. Slope Stabilization: Stabilization of the steep slopes of TP-1 and TP-2. Design studies will determine the extent to which the slopes of TP-1 and TP-2 require stabilization. Factors that EPA will consider during the design include: stability of the tailings and cover system, minimization of erosion, reduction in AMD, historic preservation, and future use of the Site.

3. Infiltration barrier cover system: Installation of an infiltration barrier cover over TP-1 and TP-2. The cover is expected to have the following layers (top to bottom):

- Soil/Vegetation layer: This layer provides support for the vegetative cover, protects the barrier layers, and allows for the retention and use of water by vegetation. It will include approximately 6 inches of topsoil and 12 inches of additional soil material. EPA will try to minimize the thickness of this layer in a manner which will preserve the protectiveness of the remedy, while reducing the amount of fill material that will have to be trucked to the Site via local roads. Alternative cover materials, such as stone, will also be evaluated during design.

- Drainage layer: This layer allows for the drainage of water that flows through the soil layer and cannot flow past the barrier layer. A geosynthetic (engineered) drainage layer provides a conduit to carry water off the barrier layer without allowing the water to pond on top of the barrier layer.

- Barrier layer: This layer prevents water from flowing into the tailings. The top barrier will be a geomembrane. During design, the need for a second barrier layer will be evaluated. If determined necessary, the second barrier layer would be a geosynthetic clay liner. The design will also evaluate the need for a barrier layer on the steep slopes. If design studies indicate that an equivalent level of erosion stabilization and infiltration reduction can be achieved using an alternative cover configuration, EPA will be consider using an alternative cover (simple soil cover or stone cover) design to preserve the profile of the slopes of TP-1 and TP-2.

- The cover system will have a final grade to promote drainage off the cover and prevent ponding on the primary barrier layer.

4. Collection and treatment of the seeps along the toe of TP-1: A collection system will be designed to capture the seeps that discharge along the toe of TP-1. This water will be treated using a combination of aerobic and anaerobic passive systems. The passive treatment system concept for TP-1 includes:

- Holding ponds to stabilize flow;
- Anoxic limestone channels to neutralize acidity;
- Anaerobic bioreactors (either Successive Alkalinity Producing Systems (SAPs), Sulfate Reducing Bacteria (SRBs) or both) to further neutralize acidity and reduce metal concentrations using organic material and limestone; and
- Aerobic wetlands to remove additional metals in a open water wetland.

A series of design studies will be performed to optimize the passive treatment system. The design may determine that some of the components above are not necessary or that some phasing of the implementation of the treatment system is appropriate to evaluate long-term flow after installation of the cap. The effluent from the treatment system will be designed to comply with the federal Clean Water Act and the State of VT Water Quality Standards.

5. Preservation of a portion of TP-3. The SHPO and VT ANR have advocated the preservation of a portion of TP-3 to the extent practical. As a result, no cover or substantial regrading will occur within the area of TP-3 that is designated for preservation. Some limited work may be performed to minimize the erosion in the area. Because the maintenance costs associated with the preservation of TP-3 will be paid for by the State of Vermont, EPA has deferred to the State for a determination regarding the amount of TP-3 to be preserved. Three preservation options were presented in the EE/CA. The three options are shown in Figure 8. VT ANR has informed EPA that only partial preservation or no preservation are viable options given the cost for the treatment system required for full preservation. Prior to the completion of the design for the NTCRA, EPA will present the VT ANR with a refined estimate of the costs to maintain a passive treatment system for TP-3. At that time, EPA will request a final determination regarding the amount of TP-3 to be preserved, if any.

6. Collection and treatment of run-off from TP-3: The flow from the area of TP-3 that is left in place due to historic preservation concerns will be collected in an interceptor trench installed along the edge of the waste rock and heap leach piles. This water will be treated using a combination of aerobic and anaerobic passive systems. The passive treatment system concept at this time includes:

- Holding ponds to stabilize flow;
- A lime application system (Semi-Active Alkalinity Dosing System) and settling basin for initial treatment prior to the anaerobic bioreactors;
- Anaerobic bioreactors (either Successive Alkalinity Producing Systems (SAPs), Sulfate Reducing Bacteria (SRBs) or both) to neutralize acidity and reduce metal concentrations using organic material and limestone; and
- Aerobic wetlands to remove additional metals in a open water wetland.

A series of design studies will be performed to optimize the passive treatment system. The effluent from the treatment system will be designed to comply with the federal Clean Water Act and the State of VT Water Quality Standards.

Capital Cost of Preferred Alternative: The approximate capital cost for Alternative 2C ranges from $13.8 million if all of TP-3 is left in place to $16 million for complete excavation of TP-3.

Post-Removal Site Control (PRSC): Long-term maintenance of the multilayer cap and passive treatment systems will be necessary to maintain the effectiveness of the cleanup. The State of Vermont will be responsible for all PRSC activities including: mowing and erosion repairs for the cover systems, cleaning the diversion ditches, sampling and maintaining the passive treatment systems, and periodic replacement of portions of the passive treatment systems. Attachment 8 contains the letter of concurrence from the State of Vermont regarding the NTCRA and the obligation for the State to perform the PRSC.

The expected cost to the State of Vermont varies considerably, depending upon the percentage of TP-3 preserved. The annual cost to maintain the cover and treatment system for TP-1 and TP-2 alone would be approximately $90,000. The estimated range of costs to treat TP-3 assuming that 20 - 50% of TP-3 is preserved ranges from $153,000 to $200,000 per year.

3. Contribution to Remedial Performance

The NTCRA proposed in this document is expected to contribute significantly to the long-term remedial action. The remedial goal for this Site is to protect human health and the environment. More specifically, the remedial response will seek to address any threats to human health or the environment that have not be resolved by the NTCRA. The removal of the source of the contamination is entirely consistent with all potential future remedial responses.

The completion of the RI/FS will focus on the need for additional source control beyond the NTCRA and the need for long-term groundwater response. Additional EE/CAs may be prepared and NTCRAs proposed if Site conditions reveal the need for source control actions in addition to those required under a future ROD.

3. Description of Alternative Technologies

In addition to the selected NTCRA described above, which utilizes capping and treatment to protect human health and the environment at the Site, other general response measures

were identified, screened, and analyzed in the EE/CA for potential applicability at the Site. All the alternatives that were described in the EE/CA (including the selected NTCRA alternative) included the following baseline items:

- Preservation of a portion of TP-3 to protect historic resources (up to 100%, exact amount to be determined during design);
- Diversion of surface water away from TP-1, TP-2 and TP-3;
- Collection and treatment of storm water runoff and drainage from TP-3 with passive treatment systems;
- Collection and treatment of drainage from the seeps at the toe of TP-1 with passive treatment systems;
- Stabilization of the steep slope areas of TP-1 and TP-2 only as necessary to achieve acceptable long-term stability while maintaining the current tailing profile to the extent possible; and
- Backfilling/stabilization of the decant piping system beneath TP-1.

The items above represent common components of each of the cleanup alternatives. The remaining component of each cleanup alternatives is the type of cover system that would be installed over TP-1 and TP-2. Four different cover systems were developed for consideration in the EE/CA. Cleanup alternatives 2B and 2C have the same multilayer cover system but differ because alternative 2B proposes to consolidate TP-2 onto TP-1 to reduce the size of the cover. Figure 7 shows a plan view of the baseline items described above and the cover system for each Alternative. Table 3 provides a summary of the costs for each alternative. The four cleanup alternatives evaluated in the EE/CA, in addition to the alternative selected for the NTCRA, are described below.

Alternative 2B (Geosynthetic Infiltration Barrier Cover System with TP-2 Removal)

In addition to the baseline items previously discussed, Alternative 2B includes:

- Consolidation of TP-2 onto TP-1;
- Consolidation of the portion of TP-3 (if any) designated for removal onto TP-1; and
- Placement of a multilayer infiltration barrier cover system over consolidated TP-1.

Capital costs for Alternative 2B range from: $13.8 to $16.7 million depending upon the percentage of TP-3 removed. The maintenance costs for the cleanup would be the responsibility of the State of Vermont. The estimated annual costs to inspect, maintain, and sample range from $82,000 - $482,000 per year depending upon the percentage of TP-3 that is retained for treatment.

Alternative 3B (Evapotranspiration Soil Cover)

Alternative 3B is a soil cover of sufficient thickness to for allow the water retention, evaporation, and transpiration properties of a vegetated soil to minimize infiltration into the tailings. In addition to the baseline items previously discussed, Alternative 3B includes:

- Consolidation of the portion of TP-3 (if any) designated for removal onto TP-1; and
- Placement of a 42 inch thick soil cover over TP-1 and TP-2 to reduce infiltration by means of evaporation and plant use.

Capital cost for Alternative 3B range from: $12.4 to $15.6 million depending upon the percentage of TP-3 removed. The maintenance costs for the cleanup would be the responsibility of the State of Vermont. The estimated annual costs to inspect, maintain, and sample range from $110,000 - $510,000 per year depending upon the percentage of TP-3 that is retained for treatment.

Alternative 3C (Minimal Soil Cover)

Alternative 3C is designed to have a minimal soil cover. Alternative 3C would only slightly reduce infiltration of water and oxygen into the tailings beyond what is currently occurring.

In addition to the baseline items previously discussed, Alternative 3C includes:

- Consolidation of the portion of TP-3 (if any) designated for removal onto TP-1; and
- Placement of the six inches of soil over the surface of TP-1 and TP-2.

Capital costs for Alternative 3C range from: $9.5 to $12.3 million depending upon the percentage of TP-3 removed. The maintenance costs for the cleanup would be the responsibility of the State of Vermont. The estimated annual costs to inspect, maintain, and sample range from $132,000 - $532,000 per year depending upon the percentage of TP-3 that is retained for treatment.

Alternative 3D (Hardpan Barrier Layer)

Alternative 3D includes a chemical cap formed by the reaction of the sulfides and carbonate to form a gypsum layer that will substantially reduce infiltration. In addition

to the baseline items previously discussed, Alternative 3D includes:

- Consolidation of the portion of TP-3 (if any) designated for removal onto TP-1;
- Placing lime and/or crushed limestone on top of the tailings to form a chemical cap on TP-1 and TP-2;
- Placement of a drainage net beneath the soil to prevent ponding of water above the hardpan layer; and
- Placement of 18 inches of soil on top of the limestone to promote a long-term vegetative cover.

Capital costs for Alternative 3D range from: $12.2 to $15 million depending upon the percentage of TP-3 removed. The maintenance costs for the cleanup would be the responsibility of the State of Vermont. The estimated annual costs to inspect, maintain, and sample range from $90,000 - $490,000 per year depending upon the percentage of TP-3 that is retained for treatment.

As required under CERCLA and the NCP, during the EE/CA process, all of the alternatives were evaluated independently based upon cost, effectiveness, and implementability. Cost was used to assess options of similar effectiveness and implementability. The direct capital, indirect capital, and post-removal site control costs (operation and maintenance) were estimated for each alternative. Effectiveness was based upon the ability of the alternative to meet the removal action objectives. The effectiveness evaluation also involved the assessment of federal and state applicable or relevant and appropriate requirements (ARARS), the short term risks associated with the alternative, timeliness, and the overall protection of human health and the environment. Implementability involved the assessment of constructability and operational issues.

In the EE/CA's independent analysis of each alternative, all of the alternatives were deemed effective in terms of overall protectiveness by reducing potential long-term risks at the Site and technical feasibility. The only significant difference between the alternatives is the cover system proposed for TP-1 and TP-2. The limited soil cover and chemical cap included in Alternatives 3C and 3D were considered to have the greatest uncertainty in meeting the objective of long-term effectiveness. Alternatives 2B, 2C, and 3B are the only cleanup alternatives with a cover system that would comply with the VT SWMR requirements for a cover system with a permeability of less than 1×10^{-5} cm/sec. As a result, only 2B, 2C, and 3B (which meet the permeability requirements) were eligible for selection as the recommended cleanup alternative.

After comparing these alternatives and weighing the strengths and weaknesses, EPA has selected Alternative 2C as presented in this cleanup plan as the best balance of human health and environmental protection considering cost, effectiveness, and implementability of each of the cleanup alternatives. The selected alternative (Alternative

2C) provides the highest degree of effectiveness and implementability. The selected alternative (Alternative 2C) fully satisfies all of the criteria under the NCP and provides the best balance of the evaluation criteria. See the EE/CA for a more detailed presentation of the cost and the basic components of each alternative.

4. EE/CA

Attachment 2 is the EE/CA Approval Memorandum, Attachment 4 is the EPA's Proposed Plan/EE/CA Fact Sheet and Attachment 5 is EPA's Response to Comments on the EE/CA and EE/CA fact Sheet. The EE/CA Report itself is found in the Administrative Record for the Site.

5. Applicable or Relevant and Appropriate Requirements

Through the EE/CA process, EPA has evaluated the universe of federal and state applicable or relevant and appropriate requirements (ARARS) which are within the scope of this NTCRA. Attachment 4 is a list of all such ARARS. EPA has determined that the selected NTCRA will be designed, constructed, operated, and maintained to attain all of the identified ARARS, in accordance with 40 C.F.R. §300.415(j), with the specific findings made under the following regulations for which public comment was sought.

(1) Unavoidable impacts to Wetlands and Floodplain:

The Wetlands below TP-1, on the surface of TP-1, adjacent to the adit, and within the stream channel of Copperas Brook from TP-3 to the outlet of TP-1, as well as floodplain areas within Copperas Brook from TP-3 to the outlet of TP-1, will be impacted by the cleanup action. Under Executive Order 11990, regarding protection of wetlands, and Executive Order 11988, regarding protection of floodplains, from federal projects, EPA has made the finding that these impacts are unavoidable as there are no practicable alternatives to the cleanup activities. The wetlands in these areas will be completely destroyed. In compliance with federal and state wetland protection standards, wetland mitigation will be included in the design. The cleanup action also involves the dredging and filling of additional wetlands and waters of the United States. Portions of Copperas Brook will be altered and re-located to separate it from the tailings. The re-location is

unavoidable as the natural channel is beneath the tailings and removal of the two million cubic yards of tailings is considered impracticable. Mitigation of the wetlands and waterway alterations will be addressed during the design phase, in accordance with federal and state standards. Any floodplain impacts will be mitigated by designing a final surface water flow system that will result in equal or better flood storage capacity

than what currently exists.

(2) Adverse Effect to a Historic Resource

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470f), requires EPA to take into account the effects of all actions on historic properties that have been determined to be eligible for the National Register of Historic Places. EPA has determined the Elizabeth Mine Site to be eligible for the National Register of Historic Places. EPA has also determined that the construction activities required to implement the cleanup will have direct and indirect impacts on features of the historic property at the Elizabeth Mine Site. EPA has determined that these impacts are unavoidable and necessary to protect human health and the environment. The preliminary Area of Potential Effect (APE) for direct effects is shown in Figure 7. The APE will be further defined to address indirect effects, cumulative effects and other effects as part of the design. EPA will work with the SHPO and other consulting parties to develop a Memorandum of Agreement (MOA) regarding the adverse effects to historic resources between the EPA, the SHPO, and other appropriate consulting parties to address any adverse effects to historic properties.

(3) Findings with respect to the VT Solid Waste Management Rules:

EPA has determined that certain requirements of the VT Solid Waste Management Rules (VT SWMR) cannot be met in order to implement the cleanup action consistent with historic preservation and community concerns regarding truck traffic and cost. EPA is making the finding that alternative measures can be taken in implementing the remedy given that:

- the proposed alternative measures to the requirements of the VT SWMR will not endanger or tend to endanger human health or safety;
- compliance with certain VT SWMR would produce serious hardship by causing the destruction of certain areas targeted for historic preservation without equal or greater benefit to the public;
- the material at the Site is not considered to be a hazardous waste subject to regulation under the Resource Conservation and Recovery Act (RCRA) Subtitle C; and
- there is no practicable means known or available to meet both the historic preservation requirements and certain requirements of the VT SWMR, however, the substitute or alternative measures proposed in this cleanup plan would achieve an equivalent level of protection of public health and the environment.

The specific alternative measures proposed to the particular requirements of the VT SWMR are detailed below:

- The design of the cleanup will determine the appropriate surface and slope grades at the Site as opposed to the minimum grade of 5% and the maximum grade of 33% specified in the VT SWMR. Performance objectives for the grading will be to: minimize ponding on the barrier layer and promote run-off; minimize erosion; minimize AMD generation; and optimize slope steepness in the interest of historic preservation.

- Final closure of exposed waste rock and heap leach piles would not be required for TP-3. EPA would design and construct a collection and treatment system to address the run-off from TP-3. The change is dependent upon VT ANR accepting the responsibility for the maintenance of the treatment system.

- Cleanup alternatives will not be required to include an infiltration barrier on the slopes of TP-1 or TP-2 if the design determines the infiltration barrier to be unnecessary to stabilize the slopes, minimize erosion, and minimize AMD generation. .

6. Project Schedule

Upon the Division Director's signature of this Action Memorandum, EPA intends to begin implementation of the design for the NTCRA with federal funds in 2002 or 2003. The NTCRA construction activities should be completed in early 2006.

B. Estimated Costs

Extramural Costs		
Regional Allowance Costs (Money from national cleanup fund with contingency)	$15,400,000	
Other extramural costs		
Contract Laboratory Program	$80,000	
State of Vermont Cooperative Agreement	$60,000	
Total Extramural Costs		$15,540,000
Intramural Cost		
Intramural Direct	$100,000	
Intramural Indirect	$100,000	
Total Intramural	$150,000	
Contingency (10%)		$1,600,000
Total Removal Projected Ceiling for this action		$17,490,000

EPA has estimated that the indirect costs of for this NTCRA would be $ 4,500,000. While the indirect costs are not included in the NTCRA ceiling, these costs would be included in the total project costs with respect to any future cost recovery action.

VII. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

If the NTCRA is not implemented, the contaminants will continue to leach from the tailings, waste rock, and heap leach piles into the surface water of Copperas Brook and the West Branch of the Ompompanoosuc River. These impacts have resulted in Copperas Brook being biologically dead and a significant impairment of five miles of the West Branch. The entire length of Copperas Brook and a six mile stretch of the West Branch fail Vermont Water Quality Standards. The cleanup plan described in this Action Memorandum would significantly reduce the impacts from the Site to the WBOR. It is possible that almost five miles of the WBOR will be restored to biological VT WQS as a result of this action. EPA also believes that the cleanup fully considers the historic value of the site and includes all reasonable measures to minimize the adverse effect to the historic resources. The cleanup will also have a high degree of long-term effectiveness and minimizes the long-term costs to the State of Vermont. The cleanup is consistent with EPA's program management goal of reducing the risk to ecological receptors to levels that will result in the recovery and maintenance of healthy local populations and communities of biota. The cleanup is also consistent with the November 20, 2001 letter from the EMCAG indicating that nine of the ten groups represented in the EMCAG support cleanup Alternative 2C (the EPA preferred alternative). In addition, there is a potential for the failure of the decant tower that runs within TP-1. Failure of this structure could expose a large area of unoxidized tailings and/or cause the accelerated erosion of the tailings resulting in a significant short term acid shock to the waterways.

VIII. OUTSTANDING POLICY ISSUES

There are only a few policy issues at this Site. The balancing of historic preservation and cleanup objectives as required by the National Historic Preservation Act has been a major issue in the development of the cleanup approach. EPA has actively consulted with the State Historic Preservation Officer, the local Native American populations, the local governmental officials, Congressional representatives, and the other stakeholders regarding this issue. All cleanup actions would have some impact on the historic resources at the Site and EPA believes the action selected in this Action Memorandum provides the best balance of the federal and state cleanup requirements and the historic preservation concerns. EPA will work with the State Historic Preservation Officer to develop a Memorandum of Agreement that documents the mitigation activities that will be implemented to address the impacts to historic resources. In addition, EPA will work with the VT ANR to develop a MOA to address the performance and financing of the O & M. The other policy issue is the use of a NTCRA to respond to an ecological threat. EPA has used the NTCRA approach at several mining sites across the county to successfully address ecological impacts from acid mine drainage. The type of action and the use of the NTCRA authority at the Elizabeth Mine Site is consistent with those precedents.

IX. ENFORCEMENT

Additional information on the enforcement strategy for this case is contained in Attachment 9 (Enforcement Confidential - Not for Public Release).

X. RECOMMENDATION

This decision document represents the selected removal action for the Elizabeth Mine Superfund Site, in Strafford, Orange County, Vermont, developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based upon the Administrative Record for the Site.

Conditions at the Site meet the NCP criteria for a removal action as specified at 40 C.F.R. § 300.415(b)(2). I recommend your approval of the proposed removal action. The total project ceiling for the NTCRA, if approved, will be $17,490,000. I also recommend and request your approval of a "consistency" exemption to the statutory limits of $2 million and one year on removal actions.

Approve ✓ Disapprove _____

Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration

Date: 11/3/2

Elizabeth Mine Superfund Site - Action Memorandum

List of Attachments

Attachment 1 - Figures and Tables
Not attached. Please refer to the Proposed Plan (linked on Elizabeth Mine web site) to view Figures and Tables.

Attachment 2 - EE/CA Approval Memo

Attachment 3 - ARARS Tables
This attachment can be viewed at the US EPA New England Superfund Records and Information Center - (617) 918-1440.

Attachment 4 - EE/CA Fact Sheet
Please refer to link on Elizabeth Mine web site.

Attachment 5 - Response to Comments
Please refer to link on Elizabeth Mine web site.

Attachment 6 - Public Hearing Transcript
This attachment can be viewed at the US EPA New England Superfund Records and Information Center - (617) 918-1440.

Attachment 7- Administrative Record Index

Attachment 8 - Concurrence Letter from VT ANR

Attachment 9 - Confidential Enforcement Addendum
This attachment is not availible for public review.

ATTACHMENT 2

EE/CA APPROVAL MEMORANDUM

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

MEMORANDUM

DATE: February 9, 2000

SUBJ: Elizabeth Copper Mine Site - Approval Memorandum to perform Engineering Evaluation/Cost Analyses for a Non-Time Critical Removal Action

FROM: Edward Hathaway, RPM ME/VT/CT Superfund Section

THRU: Donald Berger, Chief
Remediation and Restoration Branch II

Richard Cavagnero, Chief
Emergency Planning and Response Branch

TO: Patricia L. Meaney, Director
Office of Site Remediation and Restoration

I. Subject

Investigations have determined that there has been a release of hazardous substances to the environment at the Elizabeth Mine Site in Strafford, Vermont. This Site is a National Priorities List (NPL) caliber site and a listing package is being prepared by the EPA Site Assessment Program.

This memorandum documents the decision to proceed with an Engineering Evaluation/Cost Analyses (EE/CA) for a non-time critical removal action (NTCRA) at the Elizabeth Mine Site. The EE/CA will evaluate cleanup alternatives for source control measures at this Site. The EE/CA will be prepared by a contractor working for the United States Army Corps of Engineers (COE) under EPA oversight. This approval memorandum authorizes the expenditure of federal funds for the EE/CA. When the Site is listed on the NPL, the remedial investigation and feasibility study addressing all areas not fully remediated as a result of the NTCRA will be conducted.

The decision to proceed with the EE/CA is consistent with EPA guidance regarding Superfund Accelerated Cleanup Model (SACM) early actions and the long-term remedial strategy for this Site. This memorandum is not a final Agency decision regarding the selection of a response action for the Site.

ELIZABETH MINE SITE APPROVAL MEMO

II. Background

A. Site Description and History

EPA ID# VTD988366621
Geographic coordinates: 43 49' 29.0" north, 073 19' 42.3" west

The Elizabeth Mine is an abandoned copper mine located on Old Mine Road in Strafford, Vermont. Elizabeth Mine is located along the Strafford-Thetford town line in Orange County, Vermont. The area is predominantly rural/agricultural. The general area of the Elizabeth Mine covers 1,400 acres.

The Elizabeth Mine consists of three major tailings areas, two open pits, and several adits and associated buildings. Area 1 tailings form a 32 acre plateau with a maximum depth of approximately 120 feet. These tailings are composed mainly of sands and silts. Area 2 tailings are located to the southwest of the Area 1 tailings. Area 2 covers an area of approximately 5 acres and are composed of similar material. The Area 1 and Area 2 tailings were produced during the floatation process and were carried by open trough to two tailing ponds (Area 1 and Area 2) for settling of the solids.

Area 3 tailings are located further southwest of the Area 1 and 2 tailings and cover an area of approximately 5 acres. The area 3 tailings are a coarser grade than the other tailings.

The mine is currently unused and many of the buildings are in disrepair. Two of the buildings on the property are rented for residential purposes. Another building is used as a garage.

The Elizabeth Mine began operations in 1793 for the removal of iron ore and iron sulfate. Copper mining began in 1830. During the period of 1830 - 1930 an estimated 250,000 tons of ore were mined yielding approximately 5, 240 tons of copper. The copper mine was re-opened during World War II in 1943. The mine operated from 1943 to 1958. Approximately 2,967,000 tons of ore were mined to generate 50,460 tons of copper. Peak production was 1,100 tons of ore per day with 800 tons per day as the average.

Activities during the most recent operational history include blasting the ore, crushing and grinding of the ore, and then separation through a floatation process.

After the mine was closed the land was divided into two parcels. The larger parcel encompassed a 1,000 acre tract and included the open pit mines and the Area 3 tailings. A second 400 acre parcel contained the buildings and the Area 1 and Area 2 tailings. There are several owners of the property at this time.

C. Nature and Extent of Contamination

The primary source of contamination at the Elizabeth Mine are the tailings. Three major areas of tailings have been identified to date. The tailings represent a source of inorganic constituents that may be mobilized by low pH water.

Acidity of tailings and surface water runoff from the tailings piles:

Table 1
Acidity Data

Contaminant	Media	Max. Concentration
pH	Tailings	2.8
pH	surface water runoff	1.5

Heavy metals in surface water near the tailing piles:

Table 2
Maximum Surface Water Concentrations and Ecological Benchmarks

Contaminant	Media	Maximum Concentration	Chronic Water Benchmark	Acute Water Benchmark
Aluminum	Surface Water	130.000 ug/L	87 ug/L (1)	750 ug/L (2)
Cadmium	Surface Water	100 ug/L	2.61 ug/L (3)	4.92 ug/L (3)
Chromium	Surface Water	120 ug/L	11.43 ug/L (3)	16.63 ug/L (3)
Copper	Surface Water	47,000 ug/L	9.96 ug/L (3)	15.05 ug/L (3)
Iron	Surface Water	380,000ug/L	1,000 ug/L (2)	-----
Lead	Surface Water	15 ug/L	3.51 ug/L (3)	90.05 ug/L (3)
Nickel	Surface Water	1,000 ug/L	55.57 ug/L (3)	500.74 ug/L (3)
Zinc	Surface Water	12,000 ug/L	120 ug/L (3)	127.89 ug/L (3)

(1) Federal Ambient Water Quality Criterion (AWQC) Freshwater Chronic Value (EPA, 1999).
(2) Federal Ambient Water Quality Criterion (AWQC) Freshwater Acute Value (EPA, 1999).
(3) AWQC acute and chronic values derived using the default hardness value of 108 mg/L as CaCO3 based on calculated site background hardness of 108 CaCO3 (EPA, 1999), and assuming samples were unfiltered (i.e., total recoverable metals).

Table 3
Ecological Surface Water Hazard Quotients

Contaminant	Chronic Hazard Quotient	Acute Hazard Quotient
Aluminum	1494.3	173.3
Cadmium	38.3	20.3
Chromium	10.5	7.2
Copper	4718.9	3122.9
Iron	380	
Lead	4.3	0.2
Nickel	18	2
Zinc	100	93.8

**Note: The hazard quotient is the ratio of the maximum concentration to the benchmark based upon the information in Table 3.

The Site is unrestricted, which increases the opportunity for additional human exposure. Exposure to tailings particles may also occur since the tailings areas are not vegetated and therefore subject to wind erosion. An estimated 330,000 kg/yr of metals are carried from the mine via Copperas Brook. Iron accounts for approximately 80% (by weight) of the total load discharged. The remaining load is comprised of aluminum, copper, zinc, lead, and cadmium. Another 8,600 kg/yr of metals are discharged to the West Branch of the Ompompanoosuc River from a flooded air shaft. Potential receptors include downstream areas such as the Union Village Flood Control Dam, which is used substantially for swimming and fishing activities. The West Branch of the Ompompanoosuc River fisheries have been adversely impacted from the acid mine drainage and metals loading from the abandoned copper mine. It is not known whether the fish caught in these impacted areas are released, or kept for human consumption.

The major concerns for this site are the low pH of surface water and heavy metals in the site. Water in some areas is in the pH range of 1.5 to 2.0, due to oxidation of iron and sulfide in the tailings. Extensive acid mine drainage is associated with the tailings areas. These reported metals concentrations detected in surface waters most likely will have both a direct affect on aquatic organisms, and an indirect affect through the mobilization of additional toxic metals.

Sampling of biota has revealed a notable impact on the fish and invertebrate populations downstream from the Site as opposed to upstream populations. The study conducted by the Army Corps of Engineers show that standing crop of forage fish was 4.5 kg/ha upstream of the site, and

only 1.3 kg/ha downstream. This represents a biomass reduction of approximately 71%. A similar study conduct by the VT DEC noted a reduction of 86% between upstream (1,858 kg/ha) and downstream fish communities (253 kg/ha). Also, the blacknose dace collected downstream of the site weighed significantly less than fish collected from upstream locations. Acute biological effects from elevated exposure to aluminum, cadmium, chromium, copper, and zinc in surface water are likely to result in an increase in mortality to aquatic species such as fish and invertebrates. In addition, chronic biological effects such as decrease in growth and reproduction are likely to occur. All three tailing areas (Area 1, Area 2, Area 3) have areas of lacking vegetation. Area 1 had approximately five acres of deforestation. Overall the terrestrial habitat appears to be very limited, and thus the Site does not attract species typical of the area.

As noted in the attached memorandum dated October 13, 1999 from EPA New England's Aquatic Biologist/Ecological Risk Assessor, EPA New England's Office of Ecosystem Assessment highlighted the following findings:

**** Aluminum. cadmium, chromium, copper and zinc exceed the acute Ambient Water Quality Criteria (AWQC) or also known as the Continuous Maximum Criteria (CMC) at every sampling location. Surface water concentrations of aluminum and copper exceed the acute AWQC by three orders of magnitude. Aquatic organisms such as freshwater invertebrates and fish exposed to these metals concentrations in surface water will experience adverse effects such as mortality. In addition, the pH of the surface water discharge from the site is very low and will continue to mobilize those metals present and continue the loadings to the sediments.***

** Copper concentrations detected in sediment exceed the Severe Effect Level (SEL) which indicates, " a pronounced disturbance to the sediment-dwelling community can be expected.* ***This level of sediment contamination would be detrimental to the majority of benthic species and the sediments should be considered heavily contaminated" (Jaagumagi et al., 1995).***

III. Threat to Public Health, Welfare, or the Environment

Section 300.415(b)(2) of the National Contingency Plan (NCP) lists a number of factors for EPA to consider in determining whether a removal action is appropriate, including:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- (ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;
- (iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;

- (iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;

- (v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;

- (vi) Threat of fire or explosion;

- (vii) The availability of other appropriate federal or state response mechanisms to respond to the release; and

- (viii) Other situations or factors that may pose threats to public health or welfare or the environment.

An evaluation of the conditions at the Elizabeth Mine Site conclude that factors (i),(iv), (v), (vii), and (viii) are applicable as described below.

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants - At present, the contamination in the tailings, surface water, and sediment are uncontrolled and are being released into the environment. Airborne contamination in dust may present a threat to adjacent residential properties. Aquatic and terrestrial receptors are potentially impacted as a result of the low pH and the high concentration of elements in the surface water and sediments.

(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate - The tailing are not covered in a manner that prevents erosion. This erosion along with the mobilization of elements due to the low pH represent a release of hazardous substances into the environment. The hazardous substances are migrating off-site as a result of surface water transport.

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released - Local weather conditions are such that intense rain event and snow melt cause large quantities of water to come into contact with the tailings.

(vii) The availability of other appropriate federal or state response mechanisms to respond to the release - There are no other known federal or state funds or response mechanisms available to finance this action.

(viii) Other situations or factors that may pose threats to public health or welfare or the environment - The Site is located in a drainage that is part of the Connecticut River watershed. The Connecticut River has been designated as a National Heritage River.

Based upon the NCP factors listed above, a threat exists to public health or welfare or the environment due to the release of hazardous substances into the environment. A non-time critical removal action is therefore appropriate to abate, prevent, minimize, stabilize, mitigate, or eliminate such threats. In particular, a non-time critical removal action is necessary to remove, control or contain the risk from the release toxic metals into the watershed through source control measures.

This removal is designated as non-time critical because more than six months planning time is available before on-site activities must be initiated. Prior to the actual performance of a non-time critical removal at this Site, Section 300.415(b)(4) of the NCP requires that an engineering evaluation/cost analysis (EE/CA) be performed in order to weigh different response options.

IV. Scope of the EE/CA

The purpose of the EE/CA will be to evaluate alternatives for initial source control response measures related to release of low Ph water and metals from the tailings. The EE/CA will also re-evaluate the threats to public health and the environment based upon any data collected prior to the completion of the EE/CA. The EE/CA will consider alternatives which meet the following general removal action objectives:

* Prevent, to the extent practicable, direct contact with and ingestion of surface and subsurface soils that represent an unacceptable health risk;

* Prevent, to the extent practicable, the migration of inorganic substances and low pH water that represent an unacceptable threat to ecological receptors; and

* Minimize infiltration of water (precipitation, snow melt, surface water, and groundwater) into and through the tailings.

Pursuant to EPA guidance on EE/CAs, alternatives will be evaluated based upon effectiveness, [illegible] million dollars will be evaluated to determine their consistency with future remedial actions to be taken at the Site. Data gathering activities will occur at the Site to better define the relationship between groundwater, surface water, and the tailings. Some of this data will be included in the EE/CA, while other data gathering activities are more likely to be part of a pre-design effort for the NTCRA. Community involvement will be sought during the development of the EE/CA.

In developing the range of alternatives to be evaluated in each EE/CA, EPA will consider 300.415(d) of the NCP as well as relevant guidance. Section 300.415(d) of the NCP identifies various removal actions which may be appropriate in given situations, including:

.....

(2) Drainage controls, for example, run-off or run-on diversion - where needed to reduce migration of hazardous substances...;

.....

(4) Capping of contaminated soils or sludges - where needed to reduce migration of hazardous substances or pollutants or contaminants into soil, ground or surface water, or air;

.....

(6) Excavation, consolidation, or removal of highly contaminated soils from drainage or other areas - where such actions will reduce the spread of the release; and

.....

(8) Containment, treatment, disposal, or incineration of hazardous materials - where needed to reduce the likelihood of human, animal, or food chain exposures.

.....

The alternatives that are expected to be evaluated in the EE/CA are:

- Diversion of uncontaminated surface water and/or groundwater around the tailings;
- Consolidation of the tailings and capping to eliminate infiltration;
- On-Site treatment of low pH water to reduce pH and inorganic concentrations to levels acceptable for human and ecological receptors; and
- [illegible]

V. Enforcement Strategy

See the Enforcement Addendum, Attachment D, for more information regarding the EPA enforcement strategy.

VI. Estimate Costs

The EE/CA for the proposed NTCRA at the Elizabeth Mine Site will be developed by a contractor working for the US COE, under the oversight of EPA.

Extramural costs associated with the preparation of the EE/CA for the Elizabeth Mine Site, including community relations activities and development of an Administrative Record, are expected to be approximately $150,000 - $200,000. Based upon preliminary EPA estimates, costs associated with the capping and surface water diversion response actions range from $5 - $10 million. An additional $3 - $5 million could be required to collect and treat the water discharging from the tailing. Data gathering activities to support the EE/CA are expected cost approximately $300,000. Any treatment option would require Post-Removal Site Control that would the responsibility of the State of Vermont or the EPA remedial program.

VII. Other Considerations

The proposed NTCRA is expected to be consistent with any future remedial actions. The preliminary risk evaluation presented in Section II of this Approval Memo documents that the nature of the threat at the Site would require a remedial response similar in nature to the proposed NTCRA. If this Site is placed on the NPL, EPA expects to continue the Superfund process and complete a remedial investigation and feasibility study.

The State of Vermont supports an early action at this Site. A letter documenting the position of the State of Vermont is included at attachment B.

VIII. Recommendation

EPA and Vermont DEC investigations have determined that there has been a release of hazardous substances to the environment at the Site. Consistent with Section 104(b) of CERCLA, further investigation is necessary to plan and direct future response actions. We recommend your approval of this request to perform an EE/CA at the Elizabeth Mine Site. The total estimated extramural cost of performing the EE/CA is approximately $200,000.

2/9/00
Date

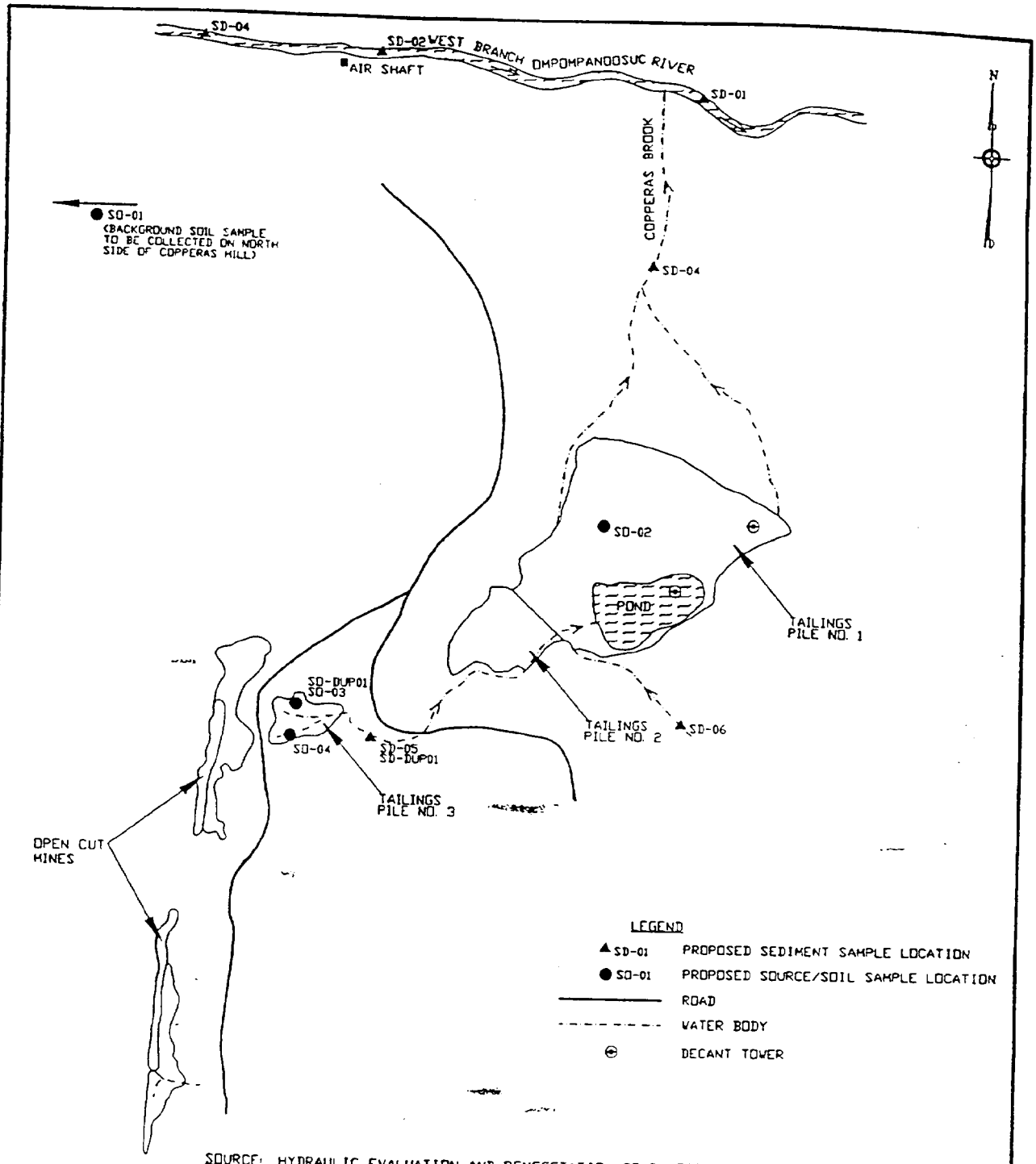
Patricia L. Meaney, Director
Office of Site Restoration and Remediation

Attachments:

A. Site Map
B. State Letter of Support
C. Ecological Risk Evaluation
D. Confidential Enforcement Addendum

ATTACHMENT A

SITE MAP



SOURCE: HYDRAULIC EVALUATION AND REVEGETATION STUDY FOR THE ELIZABETH MINE SITE, VERMONT (ARMY CORPS OF ENGINEERS, 1989)

SITE SKETCH			FIGURE 2C
ELIZABETH MINE			
STRAFFORD, VERMONT			TETRA TECH NUS, INC.
DRAWN BY:	D.W. MACDOUGALL	REV.: 0	
CHECKED BY:	K. JALKUT	DATE: AUGUST 27, 1999	
SCALE:	NOT TO SCALE	ACAD NAME: DWG\HRS\0400\FIG_2C.DWG	

55 Jonspin Road Wilmington, MA 01887
(978)658-7899

ATTACHMENT B

LETTER FROM VTDEC

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation

AGENCY OF NATURAL RESOURC
103 South Main Str
Center Buildi
Waterbury, Vermont 05671-03

October 28, 1999

Patricia Meaney, Director
Office of Site Remediation and Restoration
EPA New England
1 Congress Street
Suite 1100
Boston, MA 02114-2023

Re: Elizabeth Mine Site, Strafford, Vermont

Dear Pat:

I am writing to request the assistance of Region I's Superfund Removal Program in evaluating and responding to conditions at the Elizabeth Mine Site in Strafford, Vermont. As I believe you are aware, currently available information clearly shows that there is significant degradation of the environment adjacent to, and downstream of, the former mine operations. The result is that Copperas Brook, a tributary of the Ompompanoosuc River, has virtually no biological activity due to the extreme heavy metal loadings emanating from the mine tailing piles; effectively it is an ecological dead zone. In addition, the Ompompanoosuc itself is impacted for several miles downstream of the confluence with Copperous Brook.

Vermont's involvement in the Elizabeth Mine Site dates to the early days of watershed planning. Unfortunately, the site has languished on CERCLIS while studies have been conducted at the local, state and federal levels, and while adequate resources were sought. While Elizabeth Mine is not unlike other copper mine sites in New England in terms of the type of contamination, its location and magnitude make it one of the highest priority sites in the State. The Ompompanoosuc River is a tributary of the Connecticut River, one of the designated American Heritage Rivers. Because of the impacts associated with this mine, the Ompompanoosuc has been named one of the remaining pollution hot spots in the Connecticut River watershed in a 1998 report of the Connecticut River Forum, an organization representing the interests of the four contiguous states.

It is my understanding that the Removal Program is seeking additional budget authority in order to implement a "time critical" removal action. The rough cost estimates for a response action that would include diverting uncontaminated surface water away from the tailing piles and capping those piles is in the millions of dollars. In light of such projections, the magnitude of this problem is simply beyond the resources of our agency. The state Environmental Contingency Fund at present contains less than $500,000, and is not expected to receive replenishment at a rapid rate. Consequently, I fully support your efforts

to address this site through the Superfund Removal authority. At the same time, I recognize that Vermont needs to do its part, and I will commit this Agency to providing appropriate in-kind services or other similar support to augment EPA's efforts.

As I am sure you can appreciate, the Agency's decision to move ahead in a request for federal assistance is not in any way intended to leave the local community behind in their involvement with the project. The community has shown considerable interest in the conditions of the site, having sustained a multifaceted effort to investigate and study cleanup options. Consequently, I believe it is our mutual expectation that any federal actions will be cognizant of state and local interests at the site and respect them through a meaningful participatory process. To achieve that objective and garner local support for an EPA action, this Agency intends to provide the necessary resources and leadership to engage the local community.

I appreciate your consideration in this matter and would gladly provide additional information as requested. The Agency looks forward to a coordinated effort in solving this long standing environmental problem. Please advise me if any additional documentation is necessary to authorize the activity suggested.

Sincerely,

John Kassel
Secretary

cc: Steve Novick, EPA New England
P. Howard Flanders
George Desch
Stephan Syz
Andrew Raubvogel, Esq.

ATTACHMENT C

ECOLOGICAL RISK EVALUATION

U. S. ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND
OFFICE OF ENVIRONMENTAL MEASUREMENT & EVALUATION
OFFICE OF ECOSYSTEM ASSESSMENT
60 WESTVIEW STREET, LEXINGTON, MA 02421

MEMORANDUM

DATE: September 29, 1999

SUBJ: Preliminary Ecological Risk Evaluation for the Elizabeth Copper Mine in Strafford, Vermont

FROM: Patti Lynne Tyler
Aquatic Biologist/Ecological Risk Assessor

TO: Wing Chau
On-Scene Coordinator

Thank you for the opportunity to review the documents you forwarded with respect to the Elizabeth Copper Mine site in Strafford, VT. EPA's Office of Ecosystem Assessment along with technical assistance from Lockheed Martin's Environmental Services Assistance Team (ESAT) has conducted a preliminary ecological risk evaluation of the surface water and sediment data associated with this site. This evaluation is attached to this memorandum.

In summary, this ecological evaluation indicates that drainage from the Elizabeth Copper Mine site is having an ongoing, substantial, adverse effect on aquatic biota in the West Branch of the Ompompanoosuc River, and may adversely affect the aquatic community at downstream points along the River.

Should you have any further questions or comments with respect to this evaluation, please do not hesitate to contact me.

cc: Peter Nolan EPA/OEME/ECA

Preliminary Ecological Risk Evaluation
Elizabeth Copper Mine Site, Strafford, Vermont

INTRODUCTION

This report is a preliminary ecological risk evaluation (PERE) based on information collected over a number of years at the Elizabeth Copper Mine Site (Elizabeth Mine) in Strafford, Vermont. The site has been previously investigated by State agencies, as well as by the U.S. Geologic Survey (USGS) and private companies. A number of reports were reviewed in support of this evaluation, and the summary information regarding site history, site ecological characteristics, and chemistry data were extracted from a number of previous reports. The following sources were used in this evaluation:

Water Quality Implications and Control Techniques Associated with the Proposed Union Village Hydroelectric Project, Colorado School of Mines Research Institute, Golden, Colorado. January 31, 1984.

Hydraulic Evaluation and Revegetation Study for the Elizabeth Copper Mine Site, Strafford, Vermont, Department of the Army, Corps of Engineers, Waltham, Massachusetts. August, 1989.

Effects of the Abandoned Elizabeth Copper Mine on Fisheries Resources of the West Branch of the Ompompanoosuc River. U.S. Army Corps of Engineers, January, 1990.

Potential Hazardous Waste Site Preliminary Assessment, Vermont Agency of Natural Resources, March, 1990.

Elizabeth Mine, Old Mine Road, Strafford, Vermont, Potential Hazardous Waste Site Screening Site Inspection. Vermont Agency of Natural Resources. August, 1991.

Site Inspection Prioritization, Elizabeth Copper Mine, Strafford, Vermont, Waste Management Division, Vermont Department of Environmental Conservation (DEC), Agency of Natural Resources. October, 1998.

Hydrologic Characterization and Remediation Options for the Elizabeth Mine, South Strafford, Vermont. Step by Step Inc., and Damariscotta, Inc. February 10, 1999.

Rather than attempting to provide a comprehensive summary of the data included in the reports listed above, this evaluation uses chemical and biological data previously collected to perform a preliminary ecological risk evaluation (PERE) using frequently-used chemical screening benchmarks as an indicator of the potential risk of harm to aquatic biota near and downstream of the site.

This PERE consists of a Screening-level Problem Formulation and Ecological Effects Evaluation, and contains the following sections:

- Site history
- Environmental setting
- Nature and extent of contamination
- Preliminary exposure pathway analysis
- Screening-level methodology
- Results of the screening-level evaluation
- Discussion and conclusions
- Uncertainty analysis

This PERE is based on the use of limited site-specific information regarding the presence of ecological receptors and other natural features, therefore some of the sections listed above contain only a brief summary of the information contained in the above referenced reports.

SITE HISTORY

The Elizabeth Copper Mine (Elizabeth Mine) is an abandoned copper mine located in Strafford, Vermont. The mine complex originally encompassed approximately 1400 acres, although most investigations have been limited to the main mine complex and associated tailings piles, which are much more limited in area. The mine was discovered in 1793, and was originally used as a source of iron and iron sulfate. Copper mining did not begin until approximately 1830. Over the next hundred years, several smelters were built, and approximately 5,250 tons of copper were removed from the mine.

In 1943 the Vermont Mining Company reopened the mine to provide copper for World War II, and subsequently operated the mine until 1954, when the Vermont Mining Company sold the mine to Appalachian Sulfides, Inc., a subsidiary of Nippising Mines Company Limited of Canada (Nippising). Nipppising operated the mine until 1958, when the mine was finally closed. Between 1943 and 1958, the mine yielded 2,967,000 tons of ore, resulting in production of approximately 50,460 tons of copper.

Activities at the site during the latest period of mining included blasting ore, crushing

and grinding the ore, and followed by separation of the copper from the ore through a flotation process. Once the copper was separated from the ore, the tailing slurry was carried by open troughs to two tailings ponds, where the solids were settled. As a result of these activities, there are three major areas of tailings, which have been referred to as Area 1, Area 2, and Area 3 tailings .

Subsequent to the closure of the site for active mining, the land was divided into two parcels. One parcel included 1,000 acres containing the open pit mines and the Area 3 tailings. The other tract of 400 acres included the mine buildings and tailings areas 1 and 2. This parcel was used by a construction company to store equipment. In 1989, it was discovered that the mine was being used as a dump site for out-of-state construction /demolition debris and possibly for industrial/domestic sewage sludge. The dump site was located in the central portion of the area 1 tailings pile. According to the 1990 Vermont Agency of Natural Resources (VTANR) report, analysis of the material in the dump revealed "constituents and levels expected of typical sludges". Additional information on illegally dumped material is limited, and it is assumed in this report that the acid mine drainage and metals loading to the environment remain the primary environmental concerns at this site.

ENVIRONMENTAL SETTING

The Elizabeth Mine is located along the Strafford-Thetford town line in east-central Vermont (**Figure 1**). Strafford and Thetford are described as rural/agricultural in character. The topography of the area consists of low north-south trending ridges and valleys. The area is underlain by deposits of unstratified glacial drift (till) and bedrock (ledge). The area of the site is drained by Copperas Brook, which originates to the southwest of the site near the area 3 tailings, an older area of the mine used in the 1800's. Copperas Brook passes to the north, draining the area between Copperas Hill to the west and Gove Hill to the east. During the 1943-1958 period, Copperas Brook was diverted into a concrete pipe that became covered with tailings in area 2. At this time Copperas Brook flows in to the area 1 tailings and forms a small pond (**Figure 2**). Two unnamed brooks also drain into this pond. Some water leaves the pond through decant towers, and some percolates through the area 1 tailings (**Figure 3**). Copperas Brook ultimately discharges to the West Branch of the Ompompanoosuc River (West Branch) approximately 2,000 feet north of the mine (**Figure 2**). The West Branch originates approximately 10 miles northwest of this confluence with Copperas Brook, and ends 4.5 miles downstream where it joins the East Branch to form the Ompompanoosuc River. The Ompompanoosuc River flows about 3/4 mile to the Union Village Flood Control Dam (**Figure 4**). This dam forms a reservoir which is used for swimming and fishing.

The riverine wetlands in the West Branch are classified as upper perennial open water wetlands. Two open water lacustrine wetlands are located in the open mine pits. The pond on tailings area 1 is a flooded/temporary wetland and is classified as a palustrine

system in the flat class.

The West Branch, Ompompanoosuc River, and Connecticut Rivers are all considered potential fisheries. Species indigenous to the West Branch and Ompompanoosuc River include brown, brook, and rainbow trout. The Connecticut River also supports largemouth bass, smallmouth bass, pike, pickerel, perch, walleye, bullhead, and pan fish. Black nose dace have been collected and analyzed from the West Branch as part of past studies of the site.

As of 1989, the Army Corps of Engineers (USACE, 1989) noted the presence of small stands of common reed (*Phragmites australis*) and cattails (*Typha latifolia*) in the area 1 tailings pond. This report also noted that approximately five acres of forest has been "devegetated" at the base of tailings area 1, and that some sedges (*Carex spp.*) and cattails had become established in this area. The deforestation was attributed to sedimentation and seepage through the tailings.

Area 2 tailings were reported to support a few birch and small hemlock trees. Area 3 was reported to be devoid of vegetation except a few small birch and white pine trees growing between the tailings mounds. The degree to which this lack of vegetation is due to chemical contamination is unclear. All reports indicate low pH in the tailings, which could cause the lack of vegetation. Physical stressors, in the form of poor growing conditions in the tailings, may also be a contributor. Overall the terrestrial habitat would appear to be very limited.

In addition to the water flows discussed above, there is also a flooded air shaft which drains the lower portion of the mine complex. This air shaft now discharges directly to the Ompompanoosuc River, to the northwest of the rest of the site. Barth (1984) notes that the discharge has created a mound of precipitated iron salts approximately ten feet high and forty feet in diameter.

NATURE AND EXTENT OF CONTAMINATION

Previous investigations have included the analysis of groundwater, surface water, sediment, tailings wastes, and soil in many areas surrounding the site. One of the most comprehensive studies was performed by Richard Barth of the Colorado School of Mines Research Institute (Barth, 1984). This study contains results of analysis of sediment and surface water at various locations. The results indicate substantial loading of metals to Copperas Brook and the Ompompanoosuc River, principally from iron, and also aluminum, copper, zinc, lead and cadmium. Total metal loading from the Elizabeth Mine complex was estimated to be in the range of 329,814 kg/year in Copperas Brook, and an additional 8,639 kg/year from the flooded air shaft to the Ompompanoosuc River.

Surface water data for this evaluation was taken from the Step by Step/Damariscotta

(1999) study, which included intensive sampling of a number of stations associated with the Elizabeth Mine complex. Stations H1 through H5 were located as follows:

H1: Adjacent to the northern edge of tailings area 1
H2: On Copperas Brook north of tailings area 1
H3: Culvert on Mine Road, north of tailings area 3
H4: On the middle fork of Copperas Brook in the middle of tailings area 3
H5: On the outlet of a water-filled pit near an open cut area south of the main mine complex.

A background location was located on the Ompompanoosuc River, upstream of the influence of mine drainage.

Table 1 depicts the maximum concentrations of selected metals detected in surface waters from stations H1 through H5. With the exception of barium, all metals concentrations in surface waters collected from locations in association with the mine were elevated in comparison to background levels. Copper, aluminum, iron and zinc concentrations were present at very high concentrations.

The sediment data selected for this evaluation was collected in 1991 by the Vermont ANR (1991). Samples were taken at the following locations and analyzed for metals:

SD-1: Copperas Brook between tailings area 2 and 3
SD-2: Background, on unnamed brook upstream of tailings area 1 pond
SD-3 Copperas Brook before confluence with West Branch
SD-4: From seep along base of tailings area 1
SD-5: From second seep along base of tailings area 1

These sediments were analyzed for metals and semivolatile organic compounds (SVOCs). No SVOCs were detected in sediment. Several metals were detected, as shown in Table 2. Metals detected included arsenic, chromium, copper, lead, mercury, nickel, selenium, and zinc.

In order to evaluate data from the West Branch, sediment data from two stations along the West Branch were taken from the USACE (1990) report. Area I upstream data is from the West Branch, upstream of mine influences. Area IV downstream data is from an area of the West Branch just before the confluence with the East Branch.

An additional concern for this site is the low pH of water leaving the site. Water in some areas is in the pH range of 1.5 to 2.0 in some areas, due to the oxidation of iron and sulfide in the tailings. Extensive acid mine drainage is associated with the tailings areas. These reported metals concentrations detected in surface waters most likely will have both a direct affect on aquatic organisms, and an indirect affect through the mobilization of additional toxic metals.

PRELIMINARY EXPOSURE PATHWAY ANALYSIS

Organisms living in the sediments, surface water or foraging in the ponds and brook may be directly or indirectly exposed to site-related metals. This PERE will evaluate, in a generic manner, whether a potential risk exists to the ecological receptors living in the sediments, the benthic invertebrates and to the aquatic organisms living in the water column through the use of ecotoxicological benchmarks considered to be protective of these organisms. Although not specifically designed for this purpose, conservative sediment and water benchmarks are assumed to be generally protective of organisms that forage in the aquatic system. It is assumed, for purposes of this evaluation, that the terrestrial habitat is, at this point, so limited by the poor health and/or lack of vegetation on the site that terrestrial wildlife would not be attracted to this area.

SCREENING-LEVEL METHODOLOGY

This section presents a comparison of surface water and sediment data with ecotoxicological benchmarks appropriate for those media. The screening process involves comparing maximum detected values in the areas described above, with ecological benchmark values.

Surface water analytical results were compared with acute and chronic ambient water quality criteria (AWQC) or if not available other aquatic benchmarks as referenced in Table 1. Chronic ambient water quality criteria for the metals cadmium, copper, lead, nickel, silver and zinc are hardness dependent but the need to adjust the criteria was not necessary since the default hardness of 100 mg/L as CaCo3 reflected the hardness upstream of the West Branch which was measured as 108 mg/L as $CaCO_3$.

Table 1 presents the screening of surface water values, through comparison with background and benchmarks. The benchmarks selected for surface water include, in decreasing order of preference, the Federal Ambient Water Quality Criteria, Freshwater Acute and Chronic Acute Values (AWQC); Tier II secondary chronic and acute values (Jones and Tsao, 1996); and the EPA Eco Update *Ecotox Thresholds* (EPA,1996).

Sediment analytical results were compared to the lowest effect levels (LELs) and severe effect levels (SELs) from the Ontario Ministry of the Environment (OMOE) sediment quality guidelines (Jaagumagi et al. 1995) as these guidelines are applicable to freshwater environments. This comparison is found in **Table 2**.

RESULTS OF THE SCREENING-LEVEL EVALUATION

Tables 1 and 2 display the chemicals which exceed their respective benchmark values. Sediment concentrations of several chemicals exceeded benchmarks, in some cases by several orders of magnitude. Surface water quality is severely impacted, particularly

with aluminum, copper, iron, and zinc.

Surface Water Results

It is evident that all of the metals shown in Table 1 exceed the water quality benchmarks at some or all stations. Aluminum exceeds the surface water benchmark at every sampling location by as much as four orders of magnitude. Barium also exceeds its benchmark at all sampling locations and at the background sampling location. Aluminum. cadmium, chromium, copper and zinc exceed the acute AWQC or also known as the Continuous Maximum Criteria (CMC) at every sampling location. Aquatic organisms such as freshwater invertebrates and fish exposed to these metals concentrations in surface water are likely to experience adverse effects such as mortality. Site related surface water concentrations of lead and iron exceed chronic AWQC which could result in decreased growth, reproduction and survival to aquatic organisms.

Sediment Results

The result of comparing site specific sediment concentrations for metals with the ecological benchmarks identifies copper and lead as exceeding the lowest effect level (LEL) sediment benchmarks. The significance of a " lowest effect level indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms. Sediments at this level would be considered clean to marginally contaminated " (Jaagumagi et al., 1995). However, the copper concentrations detected in SD-1, SD-3 and SD-5 exceed the Severe Effect Level (SEL) which indicates, " a pronounced disturbance to the sediment-dwelling community can be expected. This level of sediment contamination would be detrimental to the majority of benthic species and the sediments should be considered heavily contaminated" (Jaagumagi et al., 1995). The concentration of copper detected in SD-1 is an order of magnitude greater than the SEL. The two locations from the USACE (1990) report, upstream and downstream, indicate that loading of copper in the West Branch is affecting locations downstream of the site.

DISCUSSION AND CONCLUSIONS

This PERE supports the findings of previous studies in that drainage from the copper mine is having adverse ecological effects on the associated watershed. USACE (1990) studies indicate that the mean fish standing crop in the Ompompanoosuc River for forage fish was dramatically reduced downstream of the site compared with upstream. The standing crop of forage fish was 4.5 kg/ha upstream of the site, and only 1.3 kg/ha downstream. Also, the blacknose dace collected downstream of the site weighed significantly less ($p < 0.01$ t-test) than fish collected from upstream locations.

The reduction in mean size of forage fish, and the lower standing crop, could be a result of several combined effects of the mine drainage, both direct and indirect. Acute biological effects from elevated exposure to aluminum, cadmium, chromium, copper and zinc in surface water are likely to result in an increase in mortality to aquatic species such as fish and invertebrates. In addition, chronic biological effects such as a decrease in growth and reproduction. The very low pH measures are problematic since they will continue to mobilize these metals and loading into the site-related surface water bodies. The pH might fluctuate widely with rainfall events and spring thaws, resulting in "pulses" of low-pH water flowing down Copperas Brook and the West Branch. Copper concentrations in sediments at SD-1, SD-3 and SD-5 are at levels that are detrimental to the majority or benthic organisms and additional indirect effects on forage fish might include reduced food supply resulting from toxicity of sediments to benthic organisms. The State of Vermont conducted a study of the benthic invertebrate community at two sites on the West Branch of the Ompompanoosuc River. One location was above the copper mine drainage area, and the other approximately 3,000 feet downstream of the confluence with Copperas Brook. The biological integrity of sediments at the downstream location was found to be poor, with low species richness and low Ephemeroptera, Plecoptera and Trichoptera (EPT) richness (Step by Step/Damariscotta, 1999).

The combination of data from the reports discussed in this evaluation, as well as a comparison to benchmarks, indicates that drainage from the Elizabeth Copper Mine site is having an ongoing, substantial, adverse effect on aquatic biota in the West Branch of the Ompompanoosuc River, and may adversely affect the aquatic community at downstream points along the River.

UNCERTAINTY ANALYSIS

- The benchmarks employed in this assessment are not site-specific and risk to aquatic life may be over or underestimated. For example, the Ontario Ministry of the Environment (OMOE) sediment benchmarks were used in this ecological risk evaluation because they are applicable to freshwater ecosystems. However, there are several limitations to these benchmarks. The OMOE benchmarks were derived based on a species "absence" endpoint which is considered insensitive, and therefore may not be adequately protective. Another limitation is that there is no direct cause-and effect relationship between a single contaminant and benthic organism survival. The OEME values were derived to be applicable to sediment types throughout the province of Ontario; differences between Ontario and U.S. sediments and biota introduce a level of uncertainty.

- The data used in this evaluation are from a number of different studies, and the quality of the data used were not evaluated as part of this review. Risk may be over or underestimated as a result.

REFERENCES

Barth, Richard C., 1984. *Water Quality Implications and Control Techniques Associated with the Proposed Union Village Hydroelectric Project*, Colorado School of Mines Research Institute, Golden, Colorado. January 31 1984.

Code of Federal Regulations (CFR), Title 40, Chapter 1, Subchapter D, Part 131, *Water Quality Standards*. As amended through December 22, 1992, FR 60910.

Department of the Army, Corps of Engineers (USACE). *1989. Hydraulic Evaluation and Revegetation Study for the Elizabeth Copper Mine Site, Strafford, Vermont.* Waltham, Massachusetts. August, 1989.

Department of the Army, Corps of Engineers (USACE). 1990. *Effects of the Abandoned Elizabeth Copper Mine on Fisheries Resources of the West Branch of the Ompompanoosuc River.* January, 1990.

Vermont Agency of Natural Resources. 1990. *Potential Hazardous Waste Site Preliminary Assessment*,, March, 1990.

Vermont Agency of Natural Resources. 1991. *Elizabeth Mine, Old Mine Road, Strafford, Vermont, Potential Hazardous Waste Site Screening Site Inspection.* August, 1991.

Site Inspection Prioritization, Elizabeth Copper Mine, Strafford, Vermont, Waste Management Division, Vermont Department of Environmental Conservation (DEC), Agency of Natural Resources. October, 1998.

Step by Step Inc., and Damariscotta, Inc.. 1999. H*ydrologic Characterization and Remediation Options for the Elizabeth Mine*, South Strafford, Vermont. February 10, 1999.

Ecology and Environment, Inc. (E&E), 1993. *Final Remedial Investigations Report for Areas of Contamination 4,5,18,40, Fort Devens, Massachusetts*. Prepared for the U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, Arlington, Virginia.

Jaagumagi, R., D. Persaud and D. Bedard. 1995. *Ontario's Approach to Sediment Assessment and Remediation. Second SETAC World Congress (16th Annual Meeting) Vancouver, British Columbia, Canada, November 5-9, 1995.*

Suter, G.W. and C.L. Tsao. 1996. *Toxicological Benchmarks For Screening Potential Contaminants of Concern For Effects On Aquatic Biota: 1996 Revision.* ES/ER/TM-96/R2

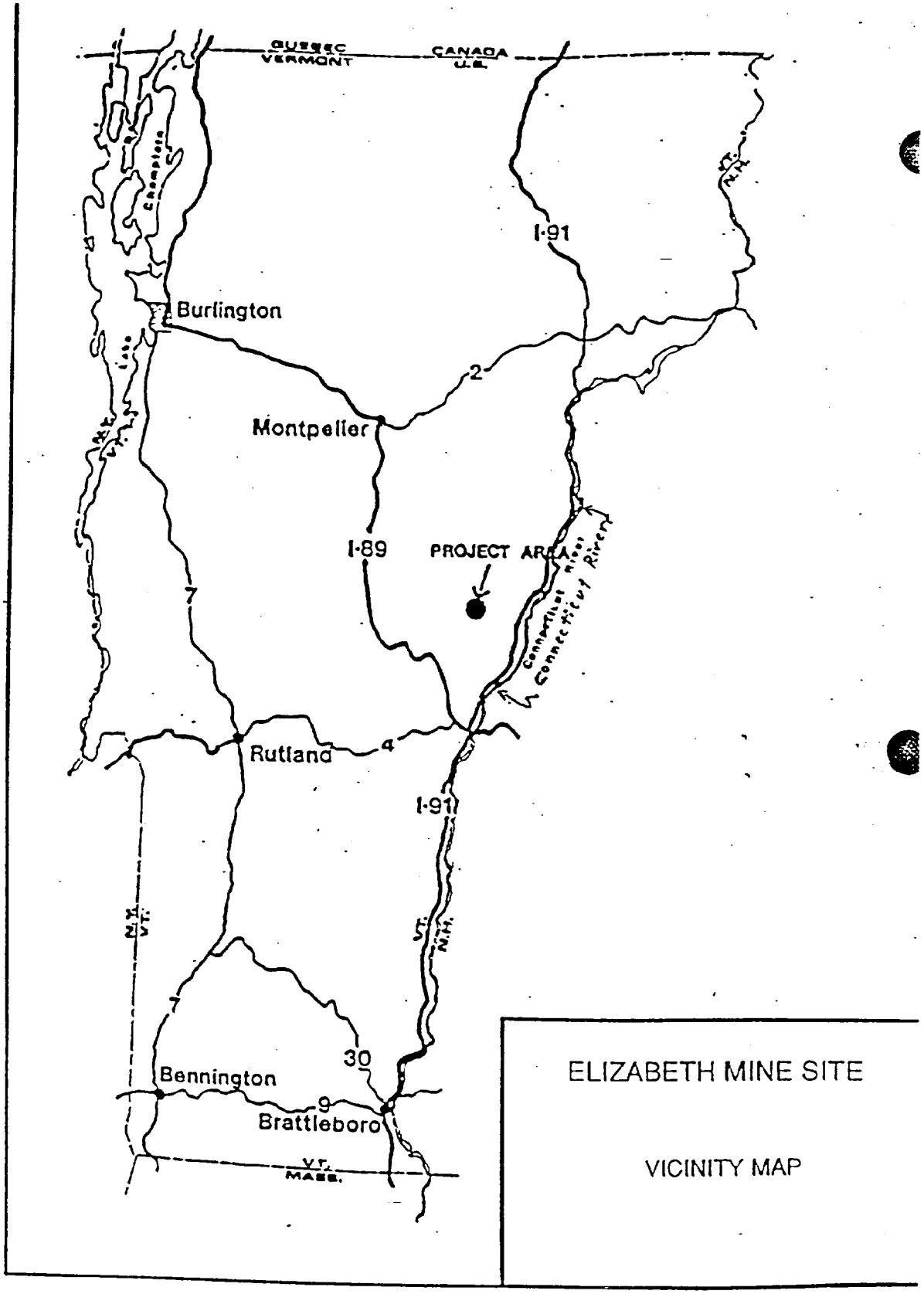
U.S. Environmental Protection Agency (USEPA). 1999. *National Recommended Water Quality Criteria - Correction.* Office of Water. EPA 822-Z-99-001. April, 1999.

U.S. Environmental Protection Agency (USEPA). 1997. *Ecological Risk Assessment Guidance For Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final.* Environmental Response Team, Edison New Jersey. June 5, 1997.

U.S. Environmental Protection Agency (USEPA). 1996. Office of Solid Waste and Emergency Response (OSWER). *ECO Update: Ecotox Thresholds.* EPA 540/F-95/038.

U.S. Environmental Protection Agency (USEPA). 1988. *Ambient Water Quality Criteria for Aluminum.* EPA 440/5-86-008. U. S. Environmental Protection Agency, Washington, D.C.

FIGURES



ELIZABETH MINE SITE

VICINITY MAP

FIGURE 1

Source: *Hydraulic Evaluation and Revegetation Study for the Elizabeth Copper Mine Site, Strafford, Vermont*, Department of the Army, Corps of Engineers, Waltham, Massachusetts. August, 1989.

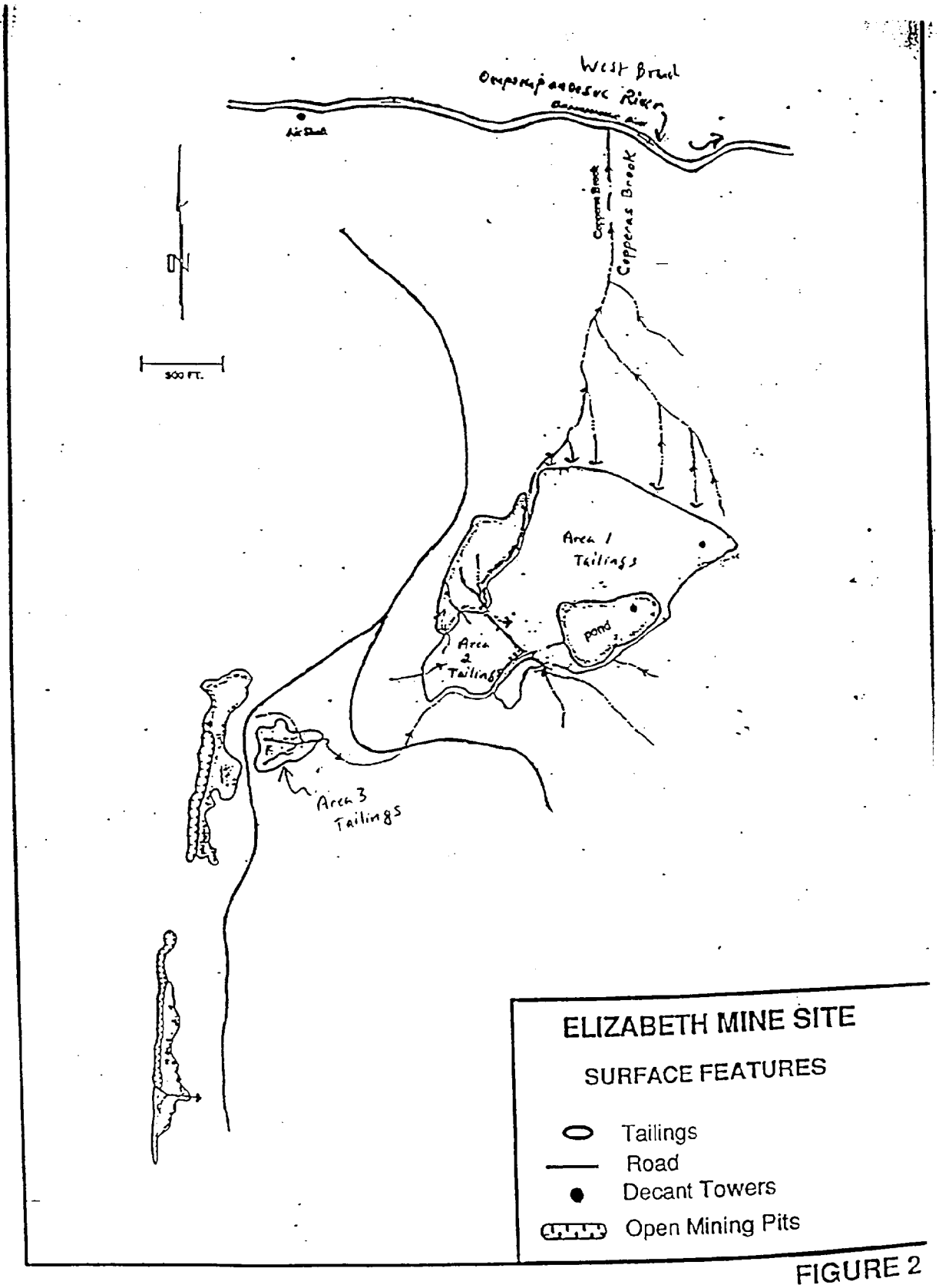
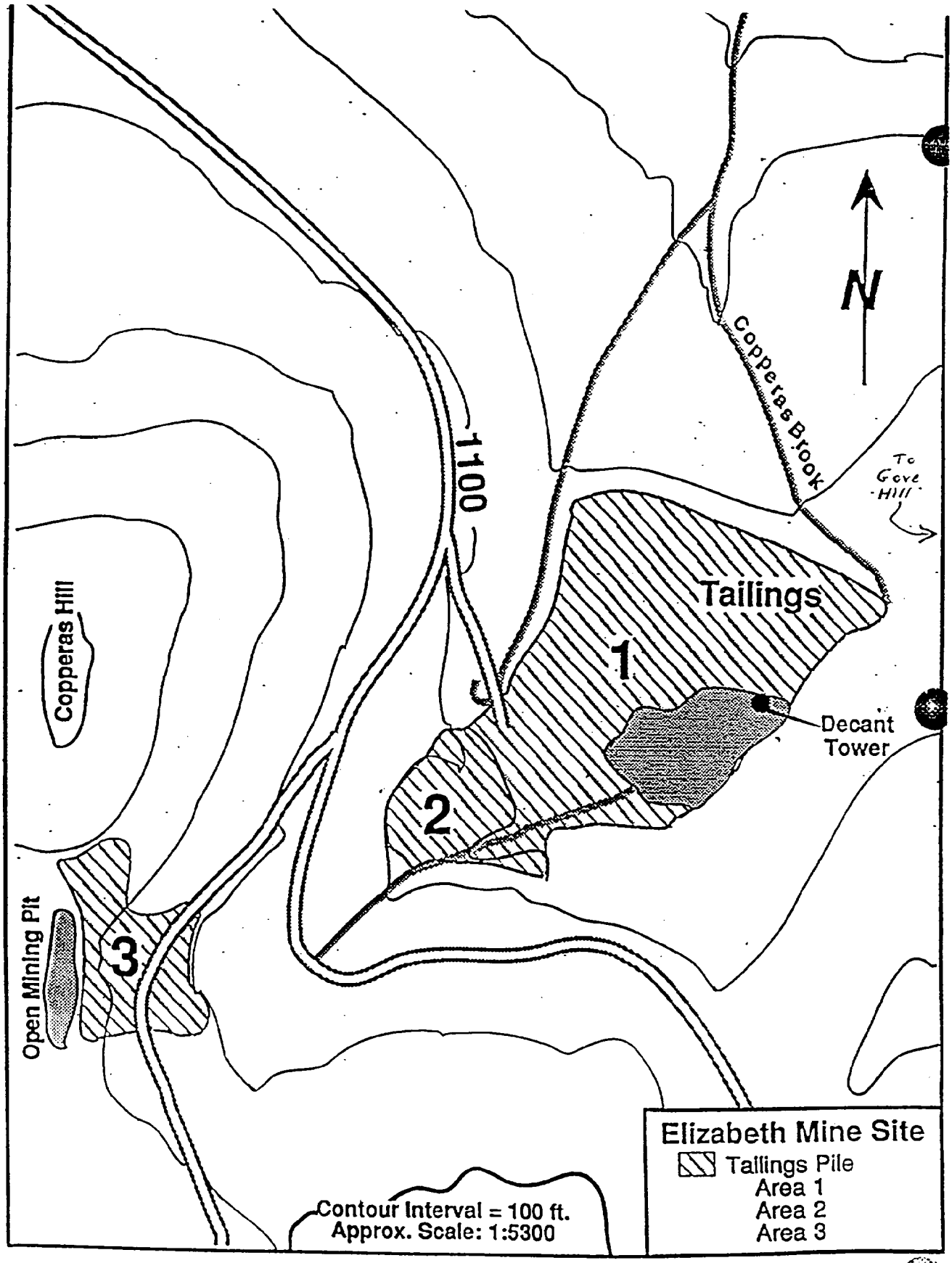


FIGURE 2

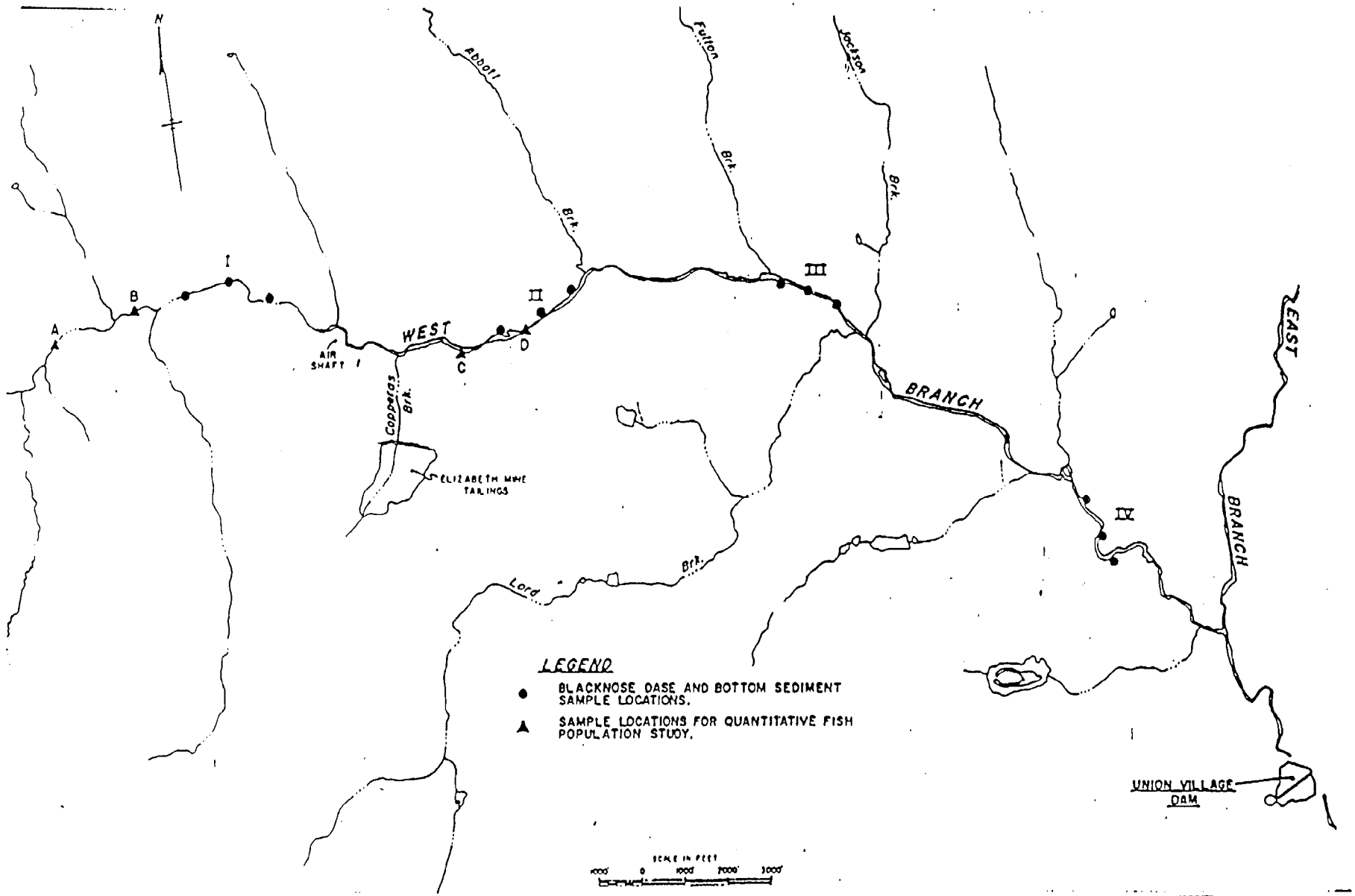
Source: *Hydraulic Evaluation and Revegetation Study for the Elizabeth Copper Mine Site, Strafford, Vermont*, Department of the Army, Corps of Engineers, Waltham, Massachusetts. August, 1989.



FIGURE

Source: *Hydraulic Evaluation and Revegetation Study for the Elizabeth Copper Mine Site, Strafford, Vermont*, Department of the Army, Corps of Engineers, Waltham, Massachusetts. August, 1989.

Figure 4



Source: Elizabeth Mine, Old Mine Road, Strafford, Vermont, Potential Hazardous Waste Site Screening Site Inspection. Vermont Agency of Natural Resources. August, 1991.

TABLES

Table 1
Ecological Screening of Surface Water Samples
Elizabeth Copper Mine - Maximum of 1998 Samples
Strafford, Vermont

Chemical	Background (a)	Sampling Station					Chronic Water Benchmark	Source	Acute Water Benchmark	Source
		H1	H2	H3	H4	H5				
Metals - ug/L										
Aluminum	33	**16000**	**13000**	**98000**	**58000**	**130000**	87	(1)	750	(2)
Barium	**46**	**20**	**23**	**57**	**8.2**	**320**	3.9	(3)	---	---
Cadmium	<0.02	**16**	**4.8**	**100**	**88**	**3**	2.61	(4)	4.92	(4)
Chromium	<1	**22**	10	**99**	**120**	**42**	11.43	(4)	16.63	(4)
Cobalt	0.06	**300**	**120**	**1600**	**1700**	**1300**	3	(3)	---	---
Copper	<0.5	**11000**	**1200**	**47000**	**47000**	**4000**	9.96	(4)	15.05	(4)
Iron	150	**52000**	**380000**	**130000**	**310000**	**150000**	1000	(2)	---	---
Lead	<0.05	1.9	0.53	15	3	3.7	3.51	(4)	90.05	(4)
Manganese	15	**2000**	**3700**	**3300**	**1300**	**14000**	80	(3)	---	---
Nickel	0.8	**63**	40	290	270	**1000**	55.57	(4)	500.74	(4)
Silver	<0.01	0.03	0.03	0.2	7.2	0.01	---	---	4.63	(4)
Zinc	<0.5	**2800**	**740**	**12000**	**10000**	**6100**	120	(4)	127.89	(4)

Notes:
(a) Background location is on the Ompompanoosuc River, 20 meters upstream of effluent from mine.
Bold text indicates that the value exceeds the chronic benchmark value.
Shading indicates that the value exceeds the acute aquatic benchmark value
(1) Federal Ambient Water Quality Criterion (AWQC) Freshwater Chronic Value (EPA, 1999).
(2) Federal Ambient Water Quality Criterion (AWQC) Freshwater Acute Value (EPA, 1999).
(3) Eco Updates Freshwater screening value (EPA, 1996)
(4) AWQC acute and chronic values derived using the default hardness value of 108 mg/L as CaCO3 based on calculated site background hardness of 108 mg/L as CaCO3 (EPA, 1999), and assuming samples were unfiltered (i.e., total recoverable metals)
Note: the value for chromium is for chromium VI, assuming the most toxic form.

Table 2
Ecological Screening of Sediment Data
Elizabeth Copper Mine Site - 1990 and 1991 Data
Strafford, Vermont

Compound	Mean Value Area I Upstream (a)	Sampling Station SD-1	SD-2	SD-3	SD-4	SD-5	Mean Value Area IV Downstream (b)	OEME LEL (1)	OEME SEL (2)
Metals - mg/kg dry weight									
Arsenic	NR	5.79	3.97	4.02	1.31	3.18	NR	6	33
Cadmium	<0.5	<0.62	<0.66	<0.67	<0.65	<0.80	<1.1	0.6	10
Chromium	22.3	12.13	20.4	17	5.09	9.81	22.6	26	110
Copper	6	**6817.63**	**101.99**	**965.19**	**62.75**	**294.59**	**105**	16	110
Lead	7	21.91	3.47	<3.35	NQ	NQ	5.2	31	250
Mercury	NR	0.053	<0.026	0.028	<0.026	<0.032	NR	0.2	2
Nickel	NR	<0.62	11.92	1.2	<0.65	<0.80	NR	16	75
Selenium	NR	12.85	1.66	3.68	<1.63	<1.99	NR		
Zinc	54.4	**165.24**	37.09	**266.4**	**156.86**	**140.13**	90.1	120	820

Notes:
NR = not reported.
(a) These values are the mean for each chemical of upstream samples taken by the USACE (1990) as depicted on Figure 4 of this report
(b) These values are the mean for each chemical of the farthest downstream samples on the West Branch, taken from USACE (1990) and depicted on Figure 4 of this report.
Bold text indicates that the concentration at this location exceeds the Lowest Effect Level
Shading indicates that the concentration at this location exceeds the Severe Effect Level
--- indicates that no benchmark was found for this chemical.
(1) Lowest Effect Level (LEL) from Jaagumagi (1995).
(2) Severe Effect Level (SEL) from Jaagumagi (1995).

ATTACHMENT 7

ADMINISTRATIVE RECORD INDEX

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

1. SITE ASSESSMENT

1. LETTER: CONCURRENCE WITH EPA'S DECISION TO NOMINATE SITE TO THE NATIONAL PRIORITIES LIST (NPL).
   TO: CAROL M BROWNER, US ENVIRONMENTAL PROTECTION AGENCY
   AUTHOR: HOWARD DEAN, VT STATE OF
   DOC ID: 29073 09/15/2000 1 PAGE

2. REPORT: FINAL HAZARD RANKING SYSTEM PACKAGE, APPENDIX B [PART 1 OF 3: SECTIONS 1 TO 26].
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 25511 10/01/2000 309 PAGES

3. REPORT: FINAL HAZARD RANKING SYSTEM PACKAGE, APPENDIX B [PART 2 OF 3: SECTIONS 27 TO 44].
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 25513 10/01/2000 326 PAGES

4. REPORT: FINAL HAZARD RANKING SYSTEM PACKAGE, APPENDIX B [PART 3 OF 3: SECTIONS 45 TO 69].
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 25514 10/01/2000 253 PAGES

5. REPORT: FINAL HAZARD RANKING SYSTEM PACKAGE, TEXT AND APPENDICES A AND C.
   TO: US EPA REGION 1
   AUTHOR: TETRA TECH NUS INC
   DOC ID: 25502 10/01/2000 103 PAGES

6. FACT SHEET: NPL SITE NARRATIVE AT LISTING.
   AUTHOR: US EPA HEADQUARTERS
   DOC ID: 25518 12/01/2000 2 PAGES

7. NEWS CLIPPING: FEDERAL REGISTER NOTICE RE: NATIONAL PRIORITY LIST (NPL) STATUS.
   AUTHOR: US EPA HEADQUARTERS
   DOC ID: 26409 12/01/2000 7 PAGES

2. REMOVAL RESPONSE

1. LETTER: CONCURRENCE WITH EPA'S DECISION TO INITIATE A NON-TIME CRITICAL REMOVAL ACTION.
   TO: PATRICIA L MEANEY, US EPA REGION 1
   AUTHOR: JOHN KASSEL, VT AGENCY OF NATURAL RESOURCES
   DOC ID: 29071 10/28/1999 2 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

2. LETTER: REQUEST FOR CONSULTATION WITH VT STATE HISTORIC PRESERVATION OFFICE (VT SHPO).
TO: MARY JANE ODONNELL, US EPA REGION 1
STEVEN R NOVICK, US EPA REGION 1
AUTHOR: EMILY WADHAMS, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
DOC ID: 25522 12/06/1999 2 PAGES

3. REPORT: SITE SUMMARY REPORT.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24130 10/01/2000 150 PAGES

4. REPORT: CONCEPTUAL MODEL OF TAILINGS PILES.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24135 11/01/2000 46 PAGES

5. REPORT: SITE CONDITIONS REPORT, DRAFT FINAL.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24131 02/01/2001 242 PAGES

6. MEMO : TECHNICAL REVIEW OF TECHNICAL BRIEFING PACKAGE, SITE SUMMARY REPORT, SITE CONDITIONS REPORT.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: DARRYL LUCE, US EPA REGION 1
DOC ID: 25551 04/11/2001 3 PAGES

7. REPORT: ENVIRONMENTAL RESPONSE ALTERNATIVES ANALYSIS REPORT, DRAFT FINAL.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24132 04/20/2001 138 PAGES

8. REPORT: HISTORICAL CONTEXT & PRELIMINARY RESOURCE EVALUATION.
TO: ARTHUR D LITTLE CO
US ARMY CORPS OF ENGINEERS
AUTHOR: PAL, INC
DOC ID: 24133 05/23/2001 136 PAGES

9. LETTER: COMMENTS ON PROPOSED PLAN.
AUTHOR: KENDALL A. MIX, STRAFFORD, TOWN OF
RODERICK J. MACLAY, STRAFFORD, TOWN OF
STEPHEN WILLBANKS, STRAFFORD, TOWN OF
DOC ID: 28795 06/01/2001 1 PAGE

10. LETTER: COMMENTS ON EPA'S ENVIRONMENTAL RESPONSE ALTERNATIVES REPORT (AAR).
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SCOTT STOKOE, ELIZABETH MINE STUDY GROUP
DOC ID: 33385 06/13/2001 4 PAGES

2.REMOVAL RESPONSE (cont)

11. LETTER: COMMENTS ON PROPOSED PLAN (INCLUDES SIGNED PETITION).
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JOHN FRIETAG, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 28811 06/17/2001 16 PAGES

12. REPORT: DRAFT ENGINEERING EVALUATION/COST ANALYSIS (EE/CA), PART 1 OF 2.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24406 09/25/2001 263 PAGES

13. REPORT: DRAFT ENGINEERING EVALUATION/COST ANALYSIS (EE/CA), PART 2 OF 2.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 32812 09/25/2001 307 PAGES

14. LETTER: COMMENTS ON ENGINEERING EVALUATION/COST ANALYSIS (EE/CA).
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: JAMES G CONDICT, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28801 11/20/2001 16 PAGES

15. REPORT: ELIZABETH MINE ENGINEERING EVALUATION/COST ANALYSIS COMMENTS AND TECHNICAL REVIEW REPORTS.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
BOB HEDIN, HEDIN ENVIRONMENTAL
BOB SEAL, US GEOLOGICAL SURVEY
CHRISTOPHER N. HATTON, URS CORPORATION
DON RUNNELLS, SHEPARD MILLER
FRANK BERGSTROM, AMERIKANUAK
JIM GUSEK, KNIGHT PIESOLD
MARCEL GUAY, URS CORPORATION
PHIL LEONHARDT, SHEPARD MILLER
DOC ID: 28594 01/22/2002 94 PAGES

16. LETTER: COMMENTS ON PROPOSED PLAN.
TO: ROBERT W VARNEY, US EPA REGION 1
AUTHOR: JOHN FRIETAG, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 29078 02/19/2002 38 PAGES

17. LETTER: COMMENTS ON PROPOSED PLAN.
TO: CHRISTINE TODD WHITMAN, US EPA
AUTHOR: RODERICK J. MACLAY, STRAFFORD, TOWN OF
DOC ID: 29076 02/21/2002 2 PAGES

18. CORRESPONDENCE: COMMENT ON EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BARBARA BLAISDELL
DOC ID: 30857 03/05/2002 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

19. CORRESPONDENCE: COMMENT ON EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: TIM UTT
DOC ID: 30858 03/05/2002 1 PAGE

20. REPORT: ENGINEERING EVALUATION/COST ANALYSIS REPORT, FINAL REPORT, BINDER 2 OF 2 [PART 1 OF 3 APPENDIX C].
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 29558 03/12/2002 347 PAGES

21. REPORT: ENGINEERING EVALUATION/COST ANALYSIS REPORT, FINAL REPORT, BINDER 2 OF 2 [PART 2 OF 3; APPENDICES C AND D].
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 29560 03/12/2002 342 PAGES

22. REPORT: ENGINEERING EVALUATION/COST ANALYSIS REPORT, FINAL REPORT, BINDER 2 OF 2 [PART 3 OF 3: APPENDICES E, F, G AND H].
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 29561 03/12/2002 274 PAGES

23. REPORT: ENGINEERING EVALUATION/COST ANALYSIS, FINAL REPORT, BINDER 1 OF 2.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 28913 03/12/2002 303 PAGES

24. CORRESPONDENCE: ACKNOWLEDGING RECEIPT OF FACT SHEET.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JEFFREY R DEACON, US GEOLOGICAL SURVEY
DOC ID: 31042 03/13/2002 1 PAGE

25. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: LYNNE MILLER
DOC ID: 30875 03/13/2002 2 PAGES

26. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: GILBERT WELCH
DOC ID: 31040 03/13/2002 1 PAGE

27. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MICHAEL SHOOB
DOC ID: 31041 03/13/2002 1 PAGE

28. CORRESPONDENCE: COMMENTS AND QUESTIONS REGARDING PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JOHN R HOFFMAN
DOC ID: 31043 03/15/2002 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

29. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JOHN MORTON, JOHN MORTON OUTDOORS
DOC ID: 31030 03/15/2002 1 PAGE

30. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MIKE HEBB
DOC ID: 31044 03/16/2002 1 PAGE

31. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN FOR REMOVAL ACTION AT THE ELIZABETH MINE SITE.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SHELDON M NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 30874 03/19/2002 2 PAGES

32. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: ELISABETH MCLANE
DOC ID: 31036 03/20/2002 1 PAGE

33. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: PATRICK A PARENTEAU, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 31045 03/20/2002 1 PAGE

34. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: LORENZ RUTZ
DOC ID: 31047 03/20/2002 1 PAGE

35. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MICHAEL MADDALENA
DOC ID: 31048 03/20/2002 1 PAGE

36. CORRESPONDENCE: PETITION TO SUPPORT MINE CLEANUP.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: ROBERT J WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31015 03/20/2002 7 PAGES

37. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MICHAEL T HARHEN
DOC ID: 31037 03/21/2002 1 PAGE

38. CORRESPONDENCE: COMMENTS ON EARLY CLEAN-UP ACTION FOR ELIZABETH MINE.
TO: GIOVANNA PEEBLES, VT DIVISION FOR HISTORIC PRESERVATION
AUTHOR: COLLAMER M ABBOTT, BUSINESS HISTORY REVIEW
DOC ID: 30861 03/21/2002 3 PAGES

2.REMOVAL RESPONSE (cont)

39. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: ARTHUR SCHALK
DOC ID: 31028 03/21/2002 3 PAGES

40. CORRESPONDENCE: PETITION TO SUPPORT MINE CLEANUP.
TO: BARBARA R OTOOLE, US EPA REGION 1
CAROL RUSSELL, US EPA REGION 8
DAVID FRANK, US EPA REGION 10
DONALD SMITH, US EPA REGION 1
EDWARD M HATHAWAY, US EPA REGION 1
MICHAEL MCGAGH, US EPA REGION 1
MIKE WIREMAN, US EPA REGION 8
NANCY SMITH, US EPA REGION 1
PATTI TYLER, US EPA REGION 8
RANDY HIPPEN, US EPA STATE TRIBAL AND SITE ID CENTER
RICHARD WILLEY, US EPA REGION 1
SARAH WHITE, US EPA REGION 1
STEVEN SCHLANG, US EPA REGION 1
SUSAN GRIFFIN, US EPA REGION 8
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: PATRICK A PARENTEAU, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 31014 03/21/2002 2 PAGES

41. CORRESPONDENCE: RESPONSE TO CASS PROPOSAL.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: ROBERT J WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31012 03/21/2002 4 PAGES

42. CORRESPONDENCE: SUPPORT FOR MINE CLEANUP.
TO: BARBARA R OTOOLE, US EPA REGION 1
CAROL RUSSELL, US EPA REGION 8
DAVID FRANK, US EPA REGION 10
DONALD SMITH, US EPA REGION 1
EDWARD M HATHAWAY, US EPA REGION 1
MICHAEL MCGAGH, US EPA REGION 1
MIKE WIREMAN, US EPA REGION 8
NANCY SMITH, US EPA REGION 1
PATTI TYLER, US EPA REGION 8
RANDY HIPPEN, US EPA STATE TRIBAL AND SITE ID CENTER
RICHARD WILLEY, US EPA REGION 1
SARAH WHITE, US EPA REGION 1
STEVEN SCHLANG, US EPA REGION 1
SUSAN GRIFFIN, US EPA REGION 8
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: MARTHA JUDY
DOC ID: 31013 03/21/2002 3 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

43. CORRESPONDENCE: AN OPEN LETTER TO THOSE QUESTIONING THE PROPOSED EPA ELIZABETH MINE CLEANUP.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: ROBERT J WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31009 03/22/2002 3 PAGES

44. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: LIANNE MOCCIA
DOC ID: 31034 03/22/2002 1 PAGE

45. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: LAUREN JEAN HARHEN
DOC ID: 31035 03/22/2002 1 PAGE

46. CORRESPONDENCE: COMMENTS ON ELIZABETH MINE CLEANUP ACTION.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: DAVID MINSK, UPPER VALLEY RIVER SUBCOMMITTEE
DOC ID: 30877 03/22/2002 2 PAGES

47. CORRESPONDENCE: MORE MINE OPINIONS.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31011 03/22/2002 1 PAGE

48. CORRESPONDENCE: PETITION TO SUPPORT MINE CLEANUP.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: STUART BLOOD
DOC ID: 31010 03/22/2002 1 PAGE

49. CORRESPONDENCE: E-MAIL DISCUSSION AND COMMENTS ON EE/CA.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: MARGO BALDWIN
DOC ID: 31006 03/25/2002 26 PAGES

50. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MARY E. SLOAT, CONNECTICUT RIVER JOINT COMMISSIONS
DOC ID: 31032 03/26/2002 1 PAGE

51. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSALS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: HEINZ H. TREBITZ
DOC ID: 31033 03/26/2002 2 PAGES

52. CORRESPONDENCE: COMMENTS ON ELIZABETH MINE CLEANUP ACTION.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MARY E. SLOAT, CONNECTICUT RIVER JOINT COMMISSIONS
NATHANIEL TRIPP, CONNECTICUT RIVER JOINT COMMISSIONS
DOC ID: 30876 03/26/2002 2 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

53. CORRESPONDENCE: E-MAIL DISCUSSION AND COMMENTS ON EE/CA.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: ROBERT J WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31008 03/26/2002 3 PAGES

54. CORRESPONDENCE: COMMENTS ON ELIZABETH MINE CLEANUP ACTION.
TO: HOWARD DEAN, VT STATE OF
AUTHOR: KATHLEEN L. CAMPBELL, STRAFFORD, TOWN OF
RODERICK J. MACLAY, STRAFFORD, TOWN OF
STEPHEN WILLBANKS, STRAFFORD, TOWN OF
DOC ID: 30878 03/27/2002 2 PAGES

55. CORRESPONDENCE: COMMENTS PROPOSED CLEANUP PLAN AND ENGINEERING EVALUATION/COST ANALYSIS (EE/CA).
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: KATHLEEN L. CAMPBELL, STRAFFORD, TOWN OF
RODERICK J. MACLAY, STRAFFORD, TOWN OF
STEPHEN WILLBANKS, STRAFFORD, TOWN OF
DOC ID: 30879 03/27/2002 2 PAGES

56. CORRESPONDENCE: E-MAIL DISCUSSION AND COMMENTS ON EE/CA.
TO: ELIZABETH MINE MAILING LIST
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 31007 03/27/2002 4 PAGES

57. CORRESPONDENCE: COMMENT ON PROPOSED ELIZABETH MINE CLEANUP PLANS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: ANDREW G. WARNER
DOC ID: 30872 03/29/2002 5 PAGES

58. CORRESPONDENCE: COMMENTS REGARDING ELIZABETH MINE EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JOHNNY JOHNSSON
DOC ID: 30898 04/02/2002 31 PAGES

59. CORRESPONDENCE: COMMENTS ON EARLY CLEANUP ACTION PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: KENNETH FINKELSTEIN, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DOC ID: 30880 04/04/2002 2 PAGES

60. CORRESPONDENCE: COMMENTS ON ELIZABETH MINE PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: HAYDEN BROWNELL
DOC ID: 30873 04/09/2002 2 PAGES

61. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: LORENZ RUTZ
RUTZ SHARI
DOC ID: 31024 04/09/2002 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

62. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN; SERIES OF WEB POSTINGS.
TO: BARBARA R OTOOLE, US EPA REGION 1
CAROL RUSSELL, US EPA REGION 8
DAVID FRANK, US EPA REGION 10
DONALD SMITH, US EPA REGION 1
EDWARD M HATHAWAY, US EPA REGION 1
MICHAEL MCGAGH, US EPA REGION 1
MIKE WIREMAN, US EPA REGION 8
NANCY SMITH, US EPA REGION 1
PATTI TYLER, US EPA REGION 8
RANDY HIPPEN, US EPA STATE TRIBAL AND SITE ID CENTER
RICHARD WILLEY, US EPA REGION 1
SARAH WHITE, US EPA REGION 1
STEVEN SCHLANG, US EPA REGION 1
SUSAN GRIFFIN, US EPA REGION 8
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: JIM MASLAND
DOC ID: 30883 04/09/2002 15 PAGES

63. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN WITH ATTACHED PETITION TO SUPPORT A CLEANUP OF THE ELIZABETH MINE.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DAVE TAPLIN, ELIZABETH MINE STUDY GROUP
DIANA WRIGHT, ELIZABETH MINE STUDY GROUP
NEAL MEGLATHERY, ELIZABETH MINE STUDY GROUP
SCOTT STOKOE, ELIZABETH MINE STUDY GROUP
DOC ID: 30899 04/10/2002 2 PAGES

64. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
AUTHOR: GEORGE DESCH, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 30890 04/10/2002 2 PAGES

65. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DAVE TAPLIN, ELIZABETH MINE STUDY GROUP
DIANA WRIGHT, ELIZABETH MINE STUDY GROUP
NEAL MEGLATHERY, ELIZABETH MINE STUDY GROUP
SCOTT STOKOE, ELIZABETH MINE STUDY GROUP
DOC ID: 30892 04/10/2002 2 PAGES

66. CORRESPONDENCE: REQUEST FOR FURTHER COMMENTS ON PROPOSED CLEANUP PLAN WITH ATTACHED LETTER TO ED HATHAWAY.
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 30895 04/10/2002 3 PAGES

67. CORRESPONDENCE: COMMENT ON PROPOSED ELIZABETH MINE CLEANUP PLANS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BARBARA BLAISDELL
DOC ID: 30869 04/11/2002 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

68. CORRESPONDENCE: COMMENT ON PROPOSED ELIZABETH MINE CLEANUP PLANS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: TIM UTT
DOC ID: 30870 04/11/2002 1 PAGE

69. CORRESPONDENCE: COMMENT ON PROPOSED ELIZABETH MINE CLEANUP PLANS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: GUY C. DENECHAUD
DOC ID: 30871 04/11/2002 1 PAGE

70. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: ANNE PEYTON, VERMONT LAW SCHOOL
DOC ID: 31019 04/11/2002 2 PAGES

71. CORRESPONDENCE: COMMENTS ON PROPOSED CLEANUP PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SCOTT P. STOKOE, THETFORD CONSERVATION COMMISSION
DOC ID: 30897 04/12/2002 2 PAGES

72. CORRESPONDENCE: COMMENTS ON PROPOSED ELIZABETH MINE CLEANUP.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BARBARA DEFELICE
CHRISTOPHER LEVEY
DOC ID: 31027 04/12/2002 1 PAGE

73. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: E. GWENDA SMITH, STRAFFORD HISTORICAL SOCIETY
DOC ID: 31016 04/12/2002 1 PAGE

74. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SARAH DREW REEVES
DOC ID: 31025 04/12/2002 1 PAGE

75. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: BRAD VIETJE
DOC ID: 31026 04/12/2002 1 PAGE

76. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
MARY JANE ODONNELL, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: JOHN THORPE
PEGGY THORPE
DOC ID: 31018 04/13/2002 3 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

77. CORRESPONDENCE: COMMENT ON PROPOSED ELIZABETH MINE CLEANUP PLANS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: FRED SCHAAFSMA
DOC ID: 30868 04/14/2002 1 PAGE

78. CORRESPONDENCE: COMMENTS ON EARLY CLEANUP ACTION FOR THE ELIZABETH MINE.
AUTHOR: JOHN FRIETAG, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 30856 04/14/2002 15 PAGES

79. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: DUANE T. EPPLER
DOC ID: 30891 04/14/2002 3 PAGES

80. CORRESPONDENCE: ELIZABETH MINE COMMENT.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JAMES SWEENEY
JUNE SWEENEY
DOC ID: 31021 04/14/2002 1 PAGE

81. CORRESPONDENCE: ELIZABETH MINE, VERMONT, PUBLIC COMMENTS.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: THOMAS K EVANS
DOC ID: 30867 04/14/2002 2 PAGES

82. CORRESPONDENCE: COMMENT ON EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JIM WILSON
JOAN WILSON
DOC ID: 30865 04/15/2002 1 PAGE

83. CORRESPONDENCE: COMMENT ON PROPOSED EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: THOMAS G ESSEX, ELIZABETH MINE PROPERTY OWNERS
DOC ID: 31022 04/15/2002 2 PAGES

84. CORRESPONDENCE: COMMENTS ON CLEANUP PROPOSAL.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: RICHARD HAMMERSLEY
DOC ID: 31031 04/15/2002 1 PAGE

85. CORRESPONDENCE: COMMENTS ON ENVIRONMENTAL EVALUATION AND COST ANALYSIS AND PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: RODERICK MACLAY, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 30881 04/15/2002 16 PAGES

86. CORRESPONDENCE: COMMENTS ON EPA'S PROPOSED "EARLY CLEANUP" PLAN FOR THE ELIZABETH MINE SITE.
AUTHOR: RICHARD W. MCGRAW
DOC ID: 30859 04/15/2002 6 PAGES

2.REMOVAL RESPONSE (cont)

87. CORRESPONDENCE: COMMENTS ON PROPOSED CLEANUP PLAN WITH ATTACHED DATA SAMPLES OF ALGAL COMMUNITIES.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: ROBERT B. GENTER, JOHNSON STATE COLLEGE
DOC ID: 30896 04/15/2002 9 PAGES

88. CORRESPONDENCE: COMMENTS ON PROPOSED CLEANUP PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SALLY MANSUR, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 31038 04/15/2002 2 PAGES

89. CORRESPONDENCE: COMMENTS ON PROPOSED EE/CA.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SUZANNA K LIEPMANN, ELIZABETH MINE PROPERTY OWNERS
DOC ID: 31039 04/15/2002 2 PAGES

90. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MARK MCMAHON, THETFORD (VT) SELECTBOARD
MARY SPATA, THETFORD (VT) SELECTBOARD
PAUL RAYMOND, THETFORD (VT) SELECTBOARD
RICK BARROWS, THETFORD (VT) SELECTBOARD
SARA FERGUSON, THETFORD (VT) SELECTBOARD
DOC ID: 31017 04/15/2002 1 PAGE

91. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: MARK CHUTE
DOC ID: 31029 04/15/2002 2 PAGES

92. CORRESPONDENCE: COMMENTS REGARDING THE PROPOSED ENVIRONMENTAL PROTECTION AGENCY (EPA)/AGENCY OF NATURAL RESOURCES CLEANUP OF THE ELIZABETH MINE SITE.
AUTHOR: ALLAN R. WYLIE
DOC ID: 30863 04/15/2002 2 PAGES

93. CORRESPONDENCE: ELIZABETH MINE COMMENT.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: SARAH ROOKER
DOC ID: 31020 04/15/2002 1 PAGE

94. CORRESPONDENCE: REPORT 7 A NEW GOAL.
AUTHOR: SHERWOOD REED, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 31023 04/15/2002 1 PAGE

95. CORRESPONDENCE: COMMENTS ON PROPOSED PLAN FOR NON-TIME CRITICAL REMOVAL ACTION.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: KENNETH C CARR, US DOI/US FISH & WILDLIFE SERVICE
DOC ID: 30888 04/16/2002 4 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

2.REMOVAL RESPONSE (cont)

96. CORRESPONDENCE: RESPONSE TO COMMENTS ON PROPOSED PLAN BY JOHN FRIETAG.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JOSHUA W HAMILTON, DARTMOUTH COLLEGE
DOC ID: 30889 04/24/2002 2 PAGES

97. LETTER: STATE CONCURRENCE, NON-TIME CRITICAL REMOVAL ACTION (NTCRA).
TO: RICHARD CAVAGNERO, US EPA REGION 1
AUTHOR: CHRISTOPHER RECCHIA, VT AGENCY OF NATURAL RESOURCES
DOC ID: 34798 08/12/2002 3 PAGES

98. MEMO : ACTION MEMORANDUM - REQUEST FOR A NON-TIME CRITICAL REMOVAL ACTION AT THE ELIZABETH MINE SUPERFUND SITE, STRAFFORD, VERMONT.
TO: RICHARD CAVAGNERO, US EPA REGION 1
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 34800 09/03/2002 273 PAGES

3. REMEDIAL INVESTIGATION (RI)

1. REPORT: HEALTH CONSULTATION, RESIDENTIAL SOIL & MINE TAILINGS.
AUTHOR: US DEPT OF HEALTH AND HUMAN SERVICES
DOC ID: 24889 9 PAGES

2. REPORT: HEALTH CONSULTATION. AN EVALUATION OF RESIDENTIAL DRINKING WATER WELLS ADJACENT TO THE ELIZABETH COPPER MINE SITE.
AUTHOR: US DEPT OF HEALTH AND HUMAN SERVICES
DOC ID: 24886 10/24/2000 20 PAGES

3. SAMPLING & ANALYSIS DATA: SEDIMENT AND SURFACE WATER SAMPLING DATA.
DOC ID: 25572 07/17/2001 20 PAGES

4. REPORT: SUMMARY OF PRELIMINARY ECOLOGICAL AND HUMAN HEALTH RISK EVALUATIONS.
TO: US ARMY CORPS OF ENGINEERS
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 24134 07/18/2001 59 PAGES

5. REPORT: PETITIONED HEALTH CONSULTATION, RESIDENTIAL SOIL, INDOOR DUST, AND AMBIENT AIR, ELIZABETH COPPER MINE (A/K/A ELIZABETH MINE).
AUTHOR: US DEPT OF HEALTH AND HUMAN SERVICES
DOC ID: 28596 12/28/2001 9 PAGES

9. STATE COORDINATION

1. REPORT: REPORT ON MINE POLLUTION IN THE OMPOMPANOOSUC RIVER BASIN.
AUTHOR: VT DEPT OF WATER RESOURCES
DOC ID: 24890 04/01/1969 14 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

9.STATE COORDINATION (cont)

2. MEMO : SITE DESCRIPTION & SAMPLING RESULTS.
TO: DAVID L CLOUGH, VT DEPT OF WATER RESOURCES
AUTHOR: WALLACE M MCLEAN, VT DEPT OF WATER RESOURCES
DOC ID: 24892 12/02/1977 6 PAGES

3. MEMO : MACROINVERTEBRATE COMMUNITY INTEGRITY OF STREAMS NEAR THE ELIZABETH AND ELY MINE SITE BASED ON 2000-2001 DATA.
AUTHOR: STEVE FISKE, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 28599 02/01/2002 6 PAGES

4. MEMO : FISH COMMUNITY EVALUATIONS FOR THE OMPOMPANOOSUC RIVER AND ELY BROOK (DRAFT).
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: RICHARD LANGDON, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 28598 02/08/2002 11 PAGES

5. MEMO : FISH COMMUNITY EVALUATIONS FOR THE OMPOMPANOOSUC RIVER AND ELY BROOK.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: RICHARD LANGDON, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 28597 02/08/2002 8 PAGES

6. CORRESPONDENCE: SOLID WASTE MANAGEMENT RULES - PROPOSED REVISIONS.
AUTHOR: GEORGE DESCH, VT DEPT OF ENVIRONMENTAL CONSERVATION
DOC ID: 31050 02/14/2002 2 PAGES

7. CORRESPONDENCE: COMMENTS ON REVISION OF SOLID WASTE MANAGEMENT RULES.
TO: GEORGE DESCH, VT DEPT OF ENVIRONMENTAL CONSERVATION
AUTHOR: SHELDON NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 31051 03/07/2002 3 PAGES

8. LETTER: DISCUSSION OF IMPACT OF A PROPOSED AMENDMENT TO VERMONT'S SOLID WASTE MANAGEMENT RULES.
TO: GEORGE DESCH, VT DEPT OF ENVIRONMENTAL CONSERVATION
AUTHOR: ELIZABETH F MASON, US EPA REGION 1
DOC ID: 29137 03/07/2002 2 PAGES

13. COMMUNITY RELATIONS

1. FACT SHEET: SUPERFUND PROGRAM, EARLY CLEAN UP ACTION FOR ELIZABETH MINE.
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 31055 30 PAGES

2. FACT SHEET, PRESS RELEASE: OUTLINE COMMUNITY INVOLVEMENT PLAN.
AUTHOR: US EPA
DOC ID: 24919 3 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

3. LETTER: LETTER DESCRIBING NON-TIME-CRITICAL REMOVAL ACTIONS.
TO: ELIZABETH MINE COMMUNITY ADVISORY GROUP
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 29139 32 PAGES

4. LETTER: RESPONSE TO FACT SHEET.
TO: CITIZENS FOR A SENSIBLE SOLUTION
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 24918 4 PAGES

5. NEWS CLIPPING: ARTICLES.
AUTHOR: COLLAMER M ABBOTT, BUSINESS HISTORY REVIEW
DOC ID: 28643 3 PAGES

6. NEWS CLIPPING: SCHOOL BUDGET UPDATE.
AUTHOR: JOHN FRIETAG, STRAFFORD, TOWN OF
KATE LINNEHAN, STRAFFORD, TOWN OF
DOC ID: 28647 1 PAGE

7. NEWS CLIPPING: SOLID BACKING FOR EPA'S MINE PLAN.
AUTHOR: SONIA SCHERR, VALLEY NEWS
DOC ID: 31053 2 PAGES

8. NEWS CLIPPING: THE ELIZABETH MINE DISCUSSION II - WHERE ARE WE NOW?
AUTHOR: SHELDON NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 24997 2 PAGES

9. PUBLIC MEETING RECORD: EPA PRESENTATION, SUMMARY OF ECOLOGICAL AND HUMAN HEALTH RISK EVALUATIONS.
AUTHOR: US EPA
DOC ID: 25012 41 PAGES

10. PUBLIC MEETING RECORD: PUBLIC MEETING COMMENTS.
AUTHOR: DEBY BOTELHO, ELIZABETH MINE FAMILIES
DOC ID: 25010 1 PAGE

11. PUBLIC MEETING RECORD: PUBLIC MEETING PRESENTATION.
AUTHOR: US EPA
DOC ID: 25011 45 PAGES

12. PUBLIC MEETING RECORD: SUPPLEMENTAL INFORMATION FOR ALTERNATIVE EVALUATION, PREPARED FOR EMCAG MEETING.
AUTHOR: US EPA
DOC ID: 25013 06/27/0001 19 PAGES

13. NEWS CLIPPING: ISAAC TYSON, JR.: PIONEER INDUSTRIALIST.
AUTHOR: COLLAMER M ABBOTT, BUSINESS HISTORY REVIEW
DOC ID: 24998 03/01/1968 9 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

14. NEWS CLIPPING: LEARNING FROM AMERICA'S PRESERVED HISTORIC MINING LANDSCAPES.
AUTHOR: RICHARD FRANCAVIGLIA, SMALL TOWNS INSTITUTE
DOC ID: 28646 07/01/1994 16 PAGES

15. NEWS CLIPPING: PROCESS BINDS METALS AT OLD GOLD MINE SITE.
AUTHOR: ANNA HASBACH, POLLUTION ENGINEERING
DOC ID: 28645 09/01/1999 1 PAGE

16. LETTER: INTRODUCTION TO ELIZABETH MINE STUDY GROUP.
TO: MARY JANE ODONNELL, US EPA REGION 1
STEVEN R NOVICK, US EPA REGION 1
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 24895 12/06/1999 2 PAGES

17. LETTER: PROPOSAL TO FORM COMMUNITY ADVISORY GROUP.
TO: MARY JANE ODONNELL, US EPA REGION 1
AUTHOR: SUZANNA K LIEPMANN, ELIZABETH MINE PROPERTY OWNERS
THOMAS G ESSEX, ELIZABETH MINE PROPERTY OWNERS
DOC ID: 24899 12/13/1999 1 PAGE

18. LETTER: DISCUSSION OF EPA COMMUNITY INVOLVEMENT ISSUES.
TO: BOB WALKER, ELIZABETH MINE STUDY GROUP
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 24904 01/06/2000 2 PAGES

19. LETTER: EPA RESPONSE TO PROPERTY OWNER CONCERNS.
TO: SUZANNA K LIEPMANN, ELIZABETH MINE PROPERTY OWNERS
THOMAS G ESSEX, ELIZABETH MINE PROPERTY OWNERS
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 24907 01/10/2000 2 PAGES

20. LETTER: NOTIFICATION OF INTEREST OF FORMING A COMMUNITY ADVISORY GROUP AND WORKING WITH EPA REGION 1.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: THOMAS G ESSEX, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28772 01/20/2000 1 PAGE

21. FACT SHEET: COMMUNITY UPDATE #1.
AUTHOR: US EPA REGION 1
DOC ID: 28605 02/01/2000 6 PAGES

22. FACT SHEET: SITE NEWSLETTER, NO. 1.
AUTHOR: VT AGENCY OF NATURAL RESOURCES
DOC ID: 28606 02/01/2000 8 PAGES

23. NEWS CLIPPING: PUBLIC MEETING IS FEB.23 ON $7-MILLION MINE CLEAN-UP.
AUTHOR: JOHN FREITAG, VALLEY NEWS
DOC ID: 28639 02/10/2000 2 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

24. LETTER: THANK YOU NOTE REGARDING THE FORMATION OF A COMMUNITY ADVISORY GROUP.
TO: THOMAS G ESSEX, ELIZABETH MINE COMMUNITY ADVISORY GROUP
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
DOC ID: 28770 02/17/2000 1 PAGE

25. NEWS CLIPPING: COPPER SOILING CONN. RIVER.
AUTHOR: SUSAN SMALLHEER, RUTLAND HERALD
DOC ID: 28638 02/22/2000 1 PAGE

26. MEMO : ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES/DISCUSSIONS WITH US ARMY CORPS OF ENGINEERS.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28899 02/23/2000 9 PAGES

27. NEWS CLIPPING: COPPER FROM OLD MINES POLLUTES CONNECTICUT RIVER.
AUTHOR: BARRE TIMES-ARGUS
DOC ID: 28641 02/23/2000 1 PAGE

28. NEWS CLIPPING: COPPER POLLUTES CONNECTICUT RIVER.
AUTHOR: NEWPORT DAILY EXPRESS
DOC ID: 28642 02/23/2000 1 PAGE

29. PUBLIC MEETING RECORD: WELCOME, ELIZABETH MINE SITE, PUBLIC MEETING, BARRETT HALL.
AUTHOR: US EPA
DOC ID: 25004 02/23/2000 22 PAGES

30. NEWS CLIPPING: MINE CLEANUP MAY START MID-'01.
AUTHOR: ALEX LEARY, VALLEY NEWS
DOC ID: 28637 02/24/2000 2 PAGES

31. NEWS CLIPPING: EPA: DOWNSTREAM COPPER LEVELS NO PROBLEM.
AUTHOR: KRISTINA EDDY, VALLEY NEWS
DOC ID: 28633 02/28/2000 2 PAGES

32. NEWS CLIPPING: LEACHING COPPER CREATING 'HOT SPOT'.
AUTHOR: SUSAN SMALLHEER, RUTLAND HERALD
DOC ID: 28636 02/28/2000 1 PAGE

33. NEWS CLIPPING: POLLUTION FEARS SPEW FROM OLD COPPER MINE.
AUTHOR: SUSAN SMALLHEER, RUTLAND HERALD
DOC ID: 28629 02/28/2000 2 PAGES

34. FACT SHEET: COMMUNITY UPDATE #2.
AUTHOR: US EPA REGION 1
DOC ID: 28604 03/01/2000 5 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

35. LIST : PETITION AGAINST SUPERFUND DESIGNATION.
AUTHOR: BARBARA MURRAY, CITIZENS FOR A SENSIBLE SOLUTION
BOB MURRAY, CITIZENS FOR A SENSIBLE SOLUTION
BRUCE MACPHAIL, CITIZENS FOR A SENSIBLE SOLUTION
DON PRESCOTT, CITIZENS FOR A SENSIBLE SOLUTION
GREG LEWIS, CITIZENS FOR A SENSIBLE SOLUTION
JOHN FREITAG, CITIZENS FOR A SENSIBLE SOLUTION
NED COFFIN, CITIZENS FOR A SENSIBLE SOLUTION
SALLY MANSUR, CITIZENS FOR A SENSIBLE SOLUTION
SHELDON NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
VI COFFIN, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 30853 03/01/2000 15 PAGES

36. NEWS CLIPPING: MINE CLEAN-UP STIRS RUCKUS IN STRAFFORD.
AUTHOR: M D DRYSDALE, HERALD OF RANDOLPH
DOC ID: 24923 03/02/2000 2 PAGES

37. NEWS CLIPPING: EXAGGERATED FEARS ABOUT MINE, LETTER TO THE EDITOR.
AUTHOR: SHELDON M NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
VALLEY NEWS
DOC ID: 24951 03/10/2000 1 PAGE

38. MEMO : SUMMARY OF MEETING DISCUSSIONS.
TO: CITIZENS FOR A SENSIBLE SOLUTION
AUTHOR: SHELDON NOVICK, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 24909 03/14/2000 4 PAGES

39. NEWS CLIPPING: CONCERNS RISE OVER SUPERFUND LABEL FOR OLD MINE.
AUTHOR: M D DRYSDALE, HERALD OF RANDOLPH
DOC ID: 24954 03/16/2000 4 PAGES

40. LETTER: REQUEST FOR ANR INVOLVEMENT.
TO: VT STATE SENATE, NATURAL RESOURCES COMMITTEE
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 24913 03/23/2000 2 PAGES

41. NEWS CLIPPING: MINE CLEANUP STAYS IN LIMBO.
AUTHOR: SUSAN SMALLHEER, RUTLAND HERALD
DOC ID: 28627 03/23/2000 2 PAGES

42. NEWS CLIPPING: OPPORTUNITY TO CLEAN MINE SITE AND RESTORE RIVER'S HEALTH.
AUTHOR: BOB WALKER, VALLEY NEWS
DOC ID: 28623 03/23/2000 2 PAGES

43. LETTER: FOLLOW-UP QUESTIONS AFTER THE FIRST ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING IN MARCH 2000.
TO: EDWARD M HATHAWAY, US EPA REGION 1
WILLIAM LOVELY, US EPA REGION 1
AUTHOR: THOMAS G ESSEX, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28900 03/24/2000 3 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

44. NEWS CLIPPING: ELIZ MINE.
AUTHOR: JIM KENYON, VALLEY NEWS
DOC ID: 28640 03/24/2000 3 PAGES

45. NEWS CLIPPING: IMPACT OF ELIZABETH MINE TAILINGS, LETTER TO THE EDITOR.
AUTHOR: JEANNIE KORNFELD, THETFORD (VT) RESIDENT
VALLEY NEWS
DOC ID: 24956 03/25/2000 1 PAGE

46. NEWS CLIPPING: MINE'S IMPACT ON THE CONNECTICUT, LETTER TO THE EDITOR, VALLEY NEWS.
AUTHOR: JAMIE HOLMES, DARTMOUTH COLLEGE
DOC ID: 24960 03/26/2000 1 PAGE

47. PUBLIC MEETING RECORD: AGENDA.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 25005 03/29/2000 1 PAGE

48. PUBLIC MEETING RECORD: ELIZABETH MINE SITE CITIZEN ADVISORY GROUP MEETING, BARRETT HALL.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 25006 03/29/2000 16 PAGES

49. NEWS CLIPPING: GOVERNMENT: CLEANUP OF MINE SLOWED.
AUTHOR: KRISTINA EDDY, VALLEY NEWS
DOC ID: 28621 03/30/2000 2 PAGES

50. NEWS CLIPPING: OFFICIALS URGE LOCAL SUPPORT FOR COPPER MINE CLEANUP WORK.
AUTHOR: SUSAN SMALLHEER, RUTLAND HERALD
DOC ID: 28619 03/30/2000 1 PAGE

51. PUBLIC MEETING RECORD: AGENDA.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 25007 04/26/2000 1 PAGE

52. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28816 04/26/2000 7 PAGES

53. NEWS CLIPPING: NEIGHBORS FEAR MINE IS 'POISONING US'.
AUTHOR: JIM KENYON, VALLEY NEWS
DOC ID: 28617 04/27/2000 2 PAGES

54. PRESS RELEASE: EPA TO HOLD AVAILABILITY SESSION ON CLEANUP ACTIVITIES AT THE ELIZABETH MINE SITE.
AUTHOR: US EPA
DOC ID: 25002 05/18/2000 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

55. NEWS CLIPPING: COPPER MINE OWNERS WANT INCOME BY BUILDING LANDFILL ON SITE.
AUTHOR: BOSTON GLOBE
DOC ID: 28644 05/24/2000 1 PAGE

56. PUBLIC MEETING RECORD: DRAFT, ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28669 06/25/2000 6 PAGES

57. NEWS CLIPPING: EPA MINE STUDY NEEDS SUPERFUND.
AUTHOR: JIM KENYON, VALLEY NEWS
DOC ID: 28616 06/29/2000 2 PAGES

58. NEWS CLIPPING: OLD MINE'S PROSPECTS UNCERTAIN, FIRST OF TWO PARTS.
AUTHOR: JIM KENYON, VALLEY NEWS
DOC ID: 24966 07/09/2000 3 PAGES

59. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28667 07/13/2000 6 PAGES

60. NEWS CLIPPING: DETAILS ON METALS FOUND NEAR ELIZABETH MINE SITE.
AUTHOR: KRISTINA EDDY, VALLEY NEWS
DOC ID: 24989 07/16/2000 2 PAGES

61. NEWS CLIPPING: SUPERFUND DECISION LOOMING, SECOND OF TWO PARTS.
AUTHOR: JIM KENYON, VALLEY NEWS
DOC ID: 24967 07/16/2000 3 PAGES

62. NEWS CLIPPING: DONT RUSH THE ELIZABETH MINE CLEANUP.
AUTHOR: JOHN FREITAG, VALLEY NEWS
DOC ID: 24990 07/22/2000 1 PAGE

63. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28666 07/26/2000 7 PAGES

64. NEWS CLIPPING: SEEKING A SOLUTION FOR ELIZABETH MINE SITE. LETTER TO THE EDITOR.
AUTHOR: JAMES G CONDICT, ELIZABETH MINE COMMUNITY ADVISORY GROUP
VALLEY NEWS
DOC ID: 24991 08/01/2000 1 PAGE

65. LETTER: REQUEST TO RELOCATE FOUR FAMILIES LIVING ON OR NEAR SITE.
TO: MINDY LUBBER, US EPA REGION 1
AUTHOR: JAMES G CONDICT, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 24915 08/07/2000 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

66. NEWS CLIPPING: ELIZABETH MINE GROUP, FOUR NEARBY FAMILIES, SEEK RELOCATION.
AUTHOR: KRISTINA EDDY, VALLEY NEWS
DOC ID: 24993 08/21/2000 2 PAGES

67. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28664 08/23/2000 4 PAGES

68. NEWS CLIPPING: EPA PLANS BIG PUBLIC ROLE IN MINE CLEANUP.
AUTHOR: ALEX LEARY, VALLEY NEWS
DOC ID: 28615 08/24/2000 2 PAGES

69. NEWS CLIPPING: MINE CLEANUP IN STRAFFORD.
AUTHOR: VALLEY NEWS
DOC ID: 24994 09/12/2000 2 PAGES

70. NEWS CLIPPING: COALITION SEEKS SUPERFUND STATUS FOR MINE SITE.
AUTHOR: DAN BILLIN, KEENE SENTINEL
DOC ID: 24995 09/14/2000 1 PAGE

71. NEWS CLIPPING: COPPER MINE GROUP AGREES TO EPA HELP.
AUTHOR: DONNA MOXLEY
RUTLAND HERLAD
DOC ID: 28614 09/14/2000 1 PAGE

72. NEWS CLIPPING: GROUP OKS SUPERFUND DESIGNATION.
AUTHOR: DAN BILLIN, VALLEY NEWS
DOC ID: 24996 09/14/2000 1 PAGE

73. LETTER: DISCUSSION OF RELOCATION OF FOUR FAMILIES LIVING NEAR THE SITE.
TO: JAMES G CONDICT, ELIZABETH MINE COMMUNITY ADVISORY GROUP
AUTHOR: MINDY LUBBER, US EPA REGION 1
DOC ID: 24917 09/29/2000 2 PAGES

74. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28663 10/25/2000 4 PAGES

75. PRESS RELEASE: EPA PROPOSES TOXIC WASTE SITES TO SUPERFUND.
AUTHOR: US EPA
DOC ID: 25003 10/26/2000 2 PAGES

76. FACT SHEET: MINE REMEDIATION OPTION SELECTION PROCESS.
TO: ELIZABETH MINE COMMUNITY ADVISORY GROUP
AUTHOR: ARTHUR D LITTLE CO
US ARMY CORPS OF ENGINEERS
DOC ID: 28901 11/29/2000 5 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

77. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28662 11/29/2000 3 PAGES

78. PRESS RELEASE: EPA PROPOSES ABANDONED VERMONT MINE TO SUPERFUND.
AUTHOR: US EPA REGION 1
DOC ID: 28602 12/01/2000 2 PAGES

79. FACT SHEET: PASSIVE TREATMENT SYSTEM (TP3) CONCEPTUAL DESIGN PRESENTATION.
AUTHOR: ARTHUR D LITTLE CO
DOC ID: 28902 01/18/2001 29 PAGES

80. MEMO : JOHN FRIETAG'S COMMENTS ON THE JANUARY 2001 DRAFT FACT SHEET.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: CINDY COOK, ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28781 02/22/2001 1 PAGE

81. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28661 02/28/2001 3 PAGES

82. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28658 03/28/2001 3 PAGES

83. FACT SHEET: COMMUNITY UPDATE #3.
AUTHOR: US EPA REGION 1
DOC ID: 28603 04/01/2001 11 PAGES

84. FACT SHEET: MEETING PRESENTATION NOTES.
AUTHOR: US EPA REGION 1
DOC ID: 28903 04/01/2001 44 PAGES

85. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING SUMMARY.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28657 04/25/2001 1 PAGE

86. NEWS CLIPPING: FOUR OPTIONS FOR MINE CLEANUP.
AUTHOR: JODIE TILLMAN, VALLEY NEWS
DOC ID: 28618 04/26/2001 2 PAGES

87. LETTER: STRAFFORD LAND RECORDS, BOOK 40, PAGE 376, REPLY TO CONCERN OVER LIABILITY OF RESIDENTIAL PROPERTY OWNERS.
TO: JAMES SWEENEY
AUTHOR: PATRICIA L MEANEY, US EPA REGION 1
DOC ID: 28601 05/17/2001 2 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

88. FACT SHEET: MEETING PRESENTATION NOTES, HISTORICAL CONTEXT AND PRELIMINARY RESOURCE EVALUATION.
AUTHOR: US EPA REGION 1
DOC ID: 28904 05/23/2001 12 PAGES

89. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING SUMMARY.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28656 05/23/2001 3 PAGES

90. LIST : PETITION AGAINST DESIGN ALTERNATIVES.
AUTHOR: JOHN FREITAG, CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 30854 06/01/2001 12 PAGES

91. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING SUMMARY.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28655 06/27/2001 2 PAGES

92. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING SUMMARY.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28654 07/18/2001 2 PAGES

93. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28653 08/22/2001 2 PAGES

94. PUBLIC MEETING RECORD: EMCAG MEETING, EE/CA PREVIEW AND SITE UPDATE.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 25008 08/22/2001 35 PAGES

95. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28650 09/26/2001 3 PAGES

96. PUBLIC MEETING RECORD: EMCAG MEETING, DRAFT EE/CA.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 25009 09/26/2001 39 PAGES

97. LETTER: INVITATION TO ATTEND MEETING REGARDING THE IMPACTS OF CLEANUP ACTIVITIES ON HISTORIC RESOURCES (LIST OF ADDRESSEES ATTACHED).
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 29074 10/09/2001 10 PAGES

98. FACT SHEET: MEETING PRESENTATION NOTES, EPA UPDATE FOR THE ELIZABETH MINE COMMUNITY ADVISORY GROUP.
AUTHOR: US EPA REGION 1
DOC ID: 28905 10/24/2001 6 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

99. FACT SHEET: MEETING PRESENTATION NOTES, EPA UPDATE FOR THE ELIZABETH MINE COMMUNITY ADVISORY GROUP.
AUTHOR: US EPA REGION 1
DOC ID: 28906 12/12/2001 5 PAGES

100. PUBLIC MEETING RECORD: ELIZABETH MINE COMMUNITY ADVISORY GROUP MEETING MINUTES.
AUTHOR: ELIZABETH MINE COMMUNITY ADVISORY GROUP
DOC ID: 28649 12/12/2001 4 PAGES

101. NEWS CLIPPING: SAVING MINE HISTORY COMES AT A PRICE.
AUTHOR: JODIE TILLMAN, VALLEY NEWS
DOC ID: 28600 01/18/2002 2 PAGES

102. FACT SHEET: MEETING PRESENTATION NOTES, EPA UPDATE FOR THE ELIZABETH MINE COMMUNITY ADVISORY GROUP.
AUTHOR: US EPA REGION 1
DOC ID: 28907 01/23/2002 21 PAGES

103. NEWS CLIPPING: POSSIBLE FEDERAL CUTBACK MAY AFFECT SUPERFUND SITE IN STRAFFORD.
AUTHOR: ANNE WALLACE ALLEN, ASSOCIATED PRESS
DOC ID: 29077 02/26/2002 2 PAGES

104. FACT SHEET: PROPOSED CLEANUP FACT SHEET.
AUTHOR: US EPA REGION 1
DOC ID: 28964 03/01/2002 4 PAGES

105. FACT SHEET: PROPOSED PLAN.
AUTHOR: US EPA REGION 1
DOC ID: 28912 03/01/2002 29 PAGES

106. LIST : PETITION ASKING TO REVIEW CLASSIFICATION AND SCALE BACK REMEDIATION PLANS.
TO: US EPA REGION 1
VT AGENCY OF NATURAL RESOURCES
AUTHOR: CITIZENS FOR A SENSIBLE SOLUTION
DOC ID: 30855 03/01/2002 16 PAGES

107. MEETING NOTES: ELIZABETH MINE SITE PUBLIC INFORMATION MEETING, PROPOSED PLAN FOR EARLY CLEANUP ACTION (NTCRA).
AUTHOR: US EPA REGION 1
DOC ID: 31057 03/01/2002 37 PAGES

108. PUBLIC MEETING RECORD: ANNOUNCEMENT CONCERNING PUBLIC MEETING FOR THE PROPOSED PLAN.
AUTHOR: US EPA REGION 1
DOC ID: 29070 03/05/2002 1 PAGE

109. LIST : PETITION TO SUPPORT A CLEANUP OF THE ELIZABETH MINE.
AUTHOR: BOB WALKER, ELIZABETH MINE STUDY GROUP
DOC ID: 30959 03/20/2002 13 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

13.COMMUNITY RELATIONS (cont)

110. CORRESPONDENCE: REPLY TO LETTER FROM MEMBER OF THE PUBLIC.
TO: NED COFFIN, CITIZENS FOR A SENSIBLE SOLUTION
AUTHOR: MARIANNE LAMONT HORINKO, US EPA
DOC ID: 31049 03/25/2002 2 PAGES

111. NEWS CLIPPING: DONT SQUANDER BEST CHANCE TO CLEAN UP ELIZABETH MINE.
AUTHOR: PATRICK PARENTEAU, VALLEY NEWS
DOC ID: 31052 03/26/2002 1 PAGE

112. CORRESPONDENCE: CLARIFICATION OF SURVEYS SENT OUT BY "STRAFFORD NEWS" AND STATEMENT OF SUPPORT OF EE/CA.
AUTHOR: KATHLEEN L. CAMPBELL, STRAFFORD, TOWN OF
RODERICK J. MACLAY, STRAFFORD, TOWN OF
DOC ID: 30860 04/03/2002 2 PAGES

113. MEETING NOTES: ELIZABETH MINE SITE PUBLIC HEARING REGARDING PROPOSED PLAN FOR EARLY CLEANUP ACTION (NTCRA).
AUTHOR: US EPA REGION 1
DOC ID: 31059 04/10/2002 21 PAGES

114. PUBLIC MEETING RECORD: PUBLIC HEARING REGARDING PROPOSED PLAN FOR EARLY CLEANUP ACTION (NTCRA) TRANSCRIPT.
AUTHOR: CAROL A BOONE, COURT REPORTERS ASSOCIATES
DOC ID: 33522 04/10/2002 62 PAGES

115. NEWS CLIPPING: EPA GETS FINAL PLEAS ON MINE.
AUTHOR: SONIA SCHERR, VALLEY NEWS
DOC ID: 31054 04/11/2002 2 PAGES

116. CORRESPONDENCE: COMMENTS ON THE PROPOSED PLAN AT THE ELIZABETH MINE.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: JAMES W. TYSON
DOC ID: 30862 04/14/2002 1 PAGE

117. PUBLIC MEETING RECORD: OVERHEADS FOR PUBLIC MEETING ANNOUNCING THE PROPOSED PLAN.
AUTHOR: US EPA REGION 1
DOC ID: 29138 37 PAGES

14. CONGRESSIONAL RELATIONS

1. LETTER: SUPPORT FOR FUNDING OF CLEAN-UP OF THE ELIZABETH MINE SITE.
TO: BERNARD SANDERS, US CONGRESS
BOB SMITH, US SENATE
CHARLES BASS, US CONGRESS
JAMES M JEFFORDS, US SENATE
JUDD GREGG, US SENATE
PATRICK LEAHY, US SENATE
AUTHOR: MARY E. SLOAT, CONNECTICUT RIVER JOINT COMMISSIONS
NATHANIEL TRIPP, CONNECTICUT RIVER JOINT COMMISSIONS
DOC ID: 34799 07/29/2002 6 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)
16. NATURAL RESOURCE TRUSTEE

1. LETTER: CONFIRMATION OF DONNA ROBERTS AS REPATRIATION COORDINATOR.
AUTHOR: HOMER ST FRANCIS, ABENAKI NATION OF MISSISQUOI
DOC ID: 28628 12/18/1998 1 PAGE

2. LETTER: NOTIFICATION OF HISTORIC STATUS OF SITE.
TO: MARY JANE ODONNELL, US EPA REGION 1
STEVEN R NOVICK, US EPA REGION 1
AUTHOR: EMILY WADHAMS, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
DOC ID: 28626 12/06/1999 2 PAGES

3. LETTER: CONFIRMATION OF MEETING ON FEBRUARY 4, 2000.
TO: GIOVANNA PEEBLES, VT DIVISION FOR HISTORIC PRESERVATION
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 28624 01/13/2000 1 PAGE

4. LETTER: CONSULTATION WITH VERMONT STATE HISTORIC PRESERVATION OFFICE.
TO: EMILY WADHAMS, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 28625 01/13/2000 2 PAGES

5. LETTER: NATURAL RESOURCE TRUSTEE NOTIFICATION FORM.
TO: KENNETH FINKELSTEIN, US DEPT OF COMMERCE/NOAA
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 28630 05/15/2000 5 PAGES

6. LETTER: NATURAL RESOURCE TRUSTEE NOTIFICATION FORM.
TO: ANDREW RADDANT, US DEPT OF THE INTERIOR
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 28631 05/15/2000 5 PAGES

7. LETTER: INITIATION OF CONSULTATIONS WITH THE STATE HISTORIC PRESERVATION OFFICER.
TO: EMILY WADHAMS, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 28622 01/10/2001 2 PAGES

8. LETTER: VERMONT STATE HISTORIC PRESERVATION OFFICE CONCURRENCE THAT SITE IS ELIGIBLE FOR THE NATIONAL REGISTER.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: EMILY WADHAMS, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
DOC ID: 28620 03/09/2001 1 PAGE

9. LETTER: REQUEST FOR INTERVENTION REGARDING HISTORICAL VALUE OF SITE.
TO: MOLLY LAMBERT, VT AGENCY OF COMMERCE AND COMMUNITY DEVELOPMENT
AUTHOR: KENDALL A. MIX, STRAFFORD, TOWN OF
RODERICK J. MACLAY, STRAFFORD, TOWN OF
STEPHEN WILLBANKS, STRAFFORD, TOWN OF
DOC ID: 28613 06/06/2001 1 PAGE

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)

16.NATURAL RESOURCE TRUSTEE (cont)

10. LETTER: EPA ACTIVITY AT THE ELIZABETH MINE SITE IN SOUTH STRAFFORD, VT, REQUESTING CONFIRMATION OF TRIBAL INTEREST IN SITE.
TO: DONNA ROBERTS, ABENAKI NATION OF MISSISQUOI
AUTHOR: EDWARD M HATHAWAY, US EPA REGION 1
DOC ID: 28612 06/12/2001 2 PAGES

11. LETTER: NOTIFICATION OF TRIBAL INTEREST IN SITE.
TO: EDWARD M HATHAWAY, US EPA REGION 1
AUTHOR: APRIL RUSHLOW, ABENAKI NATION OF MISSISQUOI
DOC ID: 28611 09/17/2001 3 PAGES

12. LETTER: NOTIFICATION OF ADVERSE EFFECTS AT THE ELIZABETH MINE SUPERFUND SITE, STRAFFORD, VT.
TO: DON L KLIMA, ADVISORY COUNCIL ON HISTORIC PRESERVATION
AUTHOR: DONALD F BERGER, US EPA REGION 1
DOC ID: 28609 10/09/2001 51 PAGES

13. LETTER: SUMMARY OF OCTOBER 27TH SECTION 106 WORKSHOP.
TO: LINDA COOK
AUTHOR: MARY JANE ODONNELL, US EPA REGION 1
DOC ID: 28608 11/06/2001 11 PAGES

14. LETTER: PROPOSED ELIZABETH MINE SUPERFUND SITE PROJECT, RULING OF NONAPPLICABILITY OF SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT.
TO: DONALD F BERGER, US EPA REGION 1
AUTHOR: DON L KLIMA, ADVISORY COUNCIL ON HISTORIC PRESERVATION
DOC ID: 28607 11/26/2001 1 PAGE

17. SITE MANAGEMENT RECORDS

1. REPORT: SELECTED WORKS ON THE CHARACTERIZATION OF CONTAMINATED MINE DRAINAGES AND PASSIVE TREATMENT.
AUTHOR: DAVID M. HYMAN, US DEPT OF ENERGY
GEORGE R. WATZLAF, US DEPT OF ENERGY
WILLIAM W. ALJOE, US DEPT OF ENERGY
DOC ID: 28635 88 PAGES

2. REPORT: STATEMENT OF THE PROPERTY OF THE VERMONT COPPERAS CO.
AUTHOR: WILLIAM B. REYNOLDS, VERMONT COPPERAS CO.
DOC ID: 28634 01/01/1865 5 PAGES

3. REPORT: WATER QUALITY IMPLICATIONS AND CONTROL TECHNIQUES ASSOCIATED WITH THE PROPOSED UNION VILLAGE HYDROELECTRIC PROJECT.
TO: UNION VILLAGE HYDROELECTRIC COMPANY
AUTHOR: RICHARD C BARTH, COLORADO SCHOOL OF MINES RESEARCH INSTITUTE
DOC ID: 25015 01/31/1984 40 PAGES

4. REPORT: ABANDONED MINE LANDS PRELIMINARY ASSESSMENT HANDBOOK.
AUTHOR: CA ENVIRONMENTAL PROTECTION AGENCY
DOC ID: 28632 01/01/1998 135 PAGES

ELIZABETH MINE

ADMINISTRATIVE RECORD FILE
NTCRA 9/2002 (FINAL)
20. RECORDS MANAGEMENT

1. LIST : GUIDANCE DOCUMENTS FOR ELIZABETH MINE.
DOC ID: 34821 09/06/2002 1 PAGE

ATTACHMENT 8

STATE LETTER OF CONCURRENCE

State of Vermont

Department of Fish and Wildlife
Department of Forests, Parks and Recreation
Department of Environmental Conservation
State Geologist
RELAY SERVICE FOR THE HEARING IMPAIRED
1-800-253-0191 TDD>Voice
1-800-253-0195 Voice>TDD

AGENCY OF NATURAL RESOURCES
Department of Environmental Conservation

Office of the Commissioner
103 South Main Street
Building 1 South
Waterbury, VT 05671-0401

Phone: (802) 241-3808
Fax: (802) 244-5141

August 12, 2002

Mr. Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration (OSRR)
EPA New England
1 Congress Street, Suite 1100
Boston, Ma 02114-2023

Subject: Non-time Critical Removal Action (NTCRA) at the Elizabeth Mine Superfund Site in Strafford, Vermont

Dear Mr. Cavagnero:

The Vermont Department of Environmental Conservation (VT DEC) has reviewed the Action Memorandum for the NTCRA at the Elizabeth Mine Superfund Site. Before providing our response to the Action Memorandum, I would like to thank EPA for their efforts over the last few years in coordinating with the State and communities on this project.

The VT DEC believes that the proposed activities as outlined in the Action Memorandum are the surest way to meet the performance objective of the NTCRA, which is to restore the biological community of the West Branch of the Ompompanoosuc River (WBOR), yet integrate a reasonable mitigation of the damage to historic resources. This performance objective was agreed to by the community, the State of Vermont, and EPA over a year ago.

The VT DEC considers the proposed NTCRA to consist of the following components:

- Preservation of a portion of TP-3, to the extent technically feasible using passive treatment technologies and economically feasible for the VT DEC to perform the operation and maintenance.
- Diversion of the clean surface water/shallow groundwater (run-on) around all three tailing piles.
- Covering TP-1 and TP-2 with an infiltration barrier to reduce the generation of acid mine drainage (AMD) significantly from these tailings, and,
- Treatment of the remaining AMD, if applicable, using passive treatment system(s).

The VT DEC understands that as a result of initially listing the site as a Superfund Site, and by participating in this NTCRA, the State of Vermont will be responsible for operation and

maintenance (O&M) of the proposed action, which will involve maintaining the diversion structures, cover system, and any AMD treatment system(s). At this time, costs for O&M activities at the site have not been sanctioned by the Vermont Legislature. The VT DEC is committed to work diligently with the Legislature to establish the required level and system of funding to meet the O&M obligation at the site. The VT DEC also understands that a Memorandum of Agreement (MOA) must be signed between the State and EPA outlining the responsibilities of both parties concerning the NTCRA.

The VT DEC is confident that the terms of the MOA can be worked out with EPA. The VT DEC trusts that sufficient flexibility can be incorporated into the MOA to ensure the following:

- Reasonable performance standards are defined to achieve the performance objective of the NTCRA, which is to restore the biological community of the WBOR. In addition, the VT DEC asks that language be included in the MOA recognizing that the final determination of the applicable or relevant and appropriate requirements (ARARs) will be made as part of the Record of Decision.

- That EPA will demonstrate, through an initial period of performance monitoring, that any AMD treatment system installed as part of NTCRA can achieve the design requirements, which includes the ARARs. The sensitivity of the passive treatment systems to seasonal conditions would require that the initial performance monitoring extend for at least one, and likely two, complete seasonal cycles to fully demonstrate its ability to operate according to the design requirements.

Given the current budget reality for Superfund, the probability is high that funding for this proposed NTCRA will be phased. The VT DEC believes that during design and each subsequent phase of the project, any new information gained should be examined to decide whether the scope for the NTCRA is still appropriate to achieve its performance objective. In particular, VT DEC asks that during pre-design and design, EPA evaluate whether the slopes of the existing tailings of TP-1 and TP-2 are adequately stable and whether the tailings of TP-1 and TP-2 can already meet the design requirements specified in the Vermont Solid Waste Management Rules as an infiltrative barrier. The VT DEC believes that this evaluation can be accomplished by using a combination of existing and proposed geotechnical data, modeling and structural design. Including this evaluation ensures that altering the slopes and installing an infiltrative barrier will only be completed if necessary.

Before the State of Vermont can reach a conclusion about the amount, if any, of TP-3 to be preserved, the VT DEC asks that EPA provide sufficient information to decide whether the O&M costs are manageable for the preservation options. This assessment must be made as early as possible in the design because the part of TP-3 that is removed would be placed on TP-1 and TP-2 before they are capped. The VT DEC no longer considers total preservation as a viable option given the high O&M costs and uncertainty in the environmental performance of a treatment system to mitigate AMD from all of TP-3. Therefore, you may omit this option from consideration during design.

Finally, we recognize that this is a big project, having significant potential for community impacts and high costs by Vermont standards of reference. The VT DEC trusts that EPA will continue to work with the communities and the State of Vermont to reduce these implementation and financial impacts, yet still achieve the NTCRA goal of restoring the WBOR. The VT DEC believes that the proposed NTCRA is the best opportunity to provide a long-term remedy that restores the WROR at a manageable operating cost for the State of Vermont.

Thank you for your continuing interest in and attention to this project.

Sincerely,

Christopher Recchia
Commissioner

cc: Elizabeth Mine Citizen Advisory Group (EMCAG)
Strafford Selectboard
Thetford Selectboard
John Schmeltzer, Waste Management Division